

Research on Talent Cultivation in Local Applied Undergraduate Colleges Based on Cdio Engineering Education Concept under the New Engineering Background

Guo Xiang Liu

Hunan Institute of Traffic Engineering, Heng Yang, Hunan, 421009, China

Keywords: Local application-oriented undergraduate colleges, The new engineering, Cdio teaching theory, Application-oriented engineering talents, Project teaching

Abstract: This paper systematically analyzes the common problems in the training mode of engineering majors in application-oriented universities. Combined with the training objectives of new engineering talents, and referring to the engineering education concept of CDIO, this paper proposes the “1.5+1.5+0.5+0.5” training mode of engineering talents from the perspective of industrial development's demand for engineering talents. This paper expounds the training mode of new engineering talents from the aspects of education idea, education mode and school-enterprise cooperation.

1. Introduction

At present, China is implementing major strategies such as the “One Belt And One Road”, “Made in China 2025” and “Internet Plus” to upgrade its industrial structure and replace old drivers with new ones. In the process of the cultivation and transformation of the new economy, one of the main problems faced by enterprises in emerging industries is the serious shortage of applied engineering talents in line with the industrial development [1]. respectively, in 2017 the Ministry of Education held a comprehensive colleges and technical advantages of the new engineering construction research discussion, put forward the strategy of the construction of the new engineering planning, and launches the “consensus” fudan [1], “a big action” [2], and “Beijing guide” [3], further defined the connotation of new engineering construction and operation guiding ideology, pointed out the direction of the talent training for practical projects. CDIO education mode is an engineering education mode that takes engineering project design as the orientation and engineering ability cultivation as the goal, and is the latest achievement of international engineering education reform in recent years [4]. It takes the life cycle from product development to product operation as the carrier, and enables students to learn engineering in an active, practical and organically linked way between courses. Therefore, under the background of new engineering, combining with the training objectives of new engineering talents and referring to the education concept of CDIO, the teaching mode of practical courses is innovated and reformed, and the talent training system of electronic information engineering major is set up at the top. It has built a four-in-one talent training system of “core quality, project drive, integration of industry and education, and engineering environment”.

2. Problems in the Training of Engineering Professionals in Applied Universities

2.1 There Are Problems in Talent Training Mode

First of all, the applied undergraduate colleges and universities of engineering talents cultivation homogeneity is very serious, mainly by studying domestic “985”, “211” key universities related professional personnel training mode and curriculum system for professional construction, lead to talent training focused on knowledge, lack of analysis and problem solving skills, especially the lack of the cultivation of the ability of applying knowledge and professional skills, such as engineering ability.

2.2 There is a Problem with the Teaching Model

The teaching method is single, mainly based on theory teaching and demonstration, and the application of diversified practical teaching means is less, which leads to the lack of professional interest and innovation motivation of students, and it is easy for them to fear difficulties and give up learning in the learning process of professional courses.

The traditional teaching of professional courses mainly focuses on the experiment or imitative operation of a single course, with less comprehensive practice and project teaching. The knowledge points of each course are isolated, and there is a lack of coherence and unity among courses.

2.3 Insufficient Teaching Resources

There are insufficient experimental and practical training sites and hardware facilities for engineering education. Application-oriented engineering majors need to practice in the real world rather than just stay in books and theories. Therefore, high-quality training environment and training platform are essential. However, with the expansion of colleges and universities and the increase in the number of students, the construction of professional training bases in most application-oriented undergraduate schools is not in place, and the laboratory and experimental equipment are not sufficient. Lack of project teaching resources. Application-oriented colleges and universities attach less importance to practical teaching, which has fewer class hours and single professional practical teaching content. Most of the practical projects are verification, simulation and experiment. Teachers lack teaching resources such as real enterprise engineering project-based teaching materials and teaching AIDS.

2.4 Teachers Lack Industrial Experience and Engineering Background

Teachers lack experience in engineering projects. The training of engineering talents in application-oriented universities requires teachers not only to have solid professional knowledge, but also to have excellent engineering practice ability. Many engineering teachers in application-oriented universities in China come directly from school and lack the background and experience of enterprise engineering projects, so they are unable to undertake the important task of cultivating application-oriented engineering talents. In addition, due to the limitation of the evaluation system, many teachers focus on scientific research, and most of them are not willing to take temporary posts in enterprises to learn again. They lack the opportunity to participate in real engineering projects, and their engineering practice ability has not been well cultivated. Therefore, there is a serious shortage of “double-qualified” teachers, which restricts the cultivation of high-quality applied talents to a certain extent.

2.5 There Are Problems in the Ability Evaluation System of Engineering Talents

There are the following problems in the talent evaluation system of many application-oriented universities: First, the content of the talent ability evaluation system is too single, and the traditional examination and assessment method is adopted, which can not well evaluate the comprehensive quality, engineering practice ability and innovation ability of students; Second, although a relatively perfect talent ability evaluation system has been set up, the implementation of the implementation is not thorough, the examination links pay more attention to, and other links exist serious going through the formalities.

3. The Design of Training Mode of Applied Engineering Talents

In order to solve the above problems in the training of engineering professionals in application-oriented universities, it is necessary to reform the existing talent training mode, combine the training objectives of new engineering talents, and draw lessons from the CDIO education concept. The cultivation of core qualities of college students is carried through the whole teaching design, so as to realize the match between the needs of enterprises and talent training. In view of the industry needs to set goals of talent training, on the basis of profound fusion, from solid professional foundation, strengthening the professional practice ability and innovative ability, with the

development of college students' core literacy standard, with university-enterprise cooperation characteristics of "class" as the carrier of teaching, put forward the "1.5 + 1.5 + 0.5 + 0.5" new engineering personnel training mode of applied undergraduate colleges and universities.

3.1 The Design of Teaching Concept

In the teaching design of new engineering in application-oriented universities, we adopt Dewey's "Learning by doing" theory and constructivism theory as the basis, and adopt "project-based Learning" as the teaching method. Dewey the education teaching activities as a "process", and put forward the "learning by doing, from the experience," thought, the idea of "learning by doing" main highlight in the teaching process to protect the students' creativity through the practice of teaching content stimulates the student active learning, in the teaching process should be design will experience, activities, students as the center link of teaching activities. Educators should evaluate students' learning results from multiple perspectives and at multiple levels, not only the knowledge they have learned, but also the development of students' abilities [6].

Project-based learning breaks away from the traditional teacher-centered classroom, emphasizes student-centered learning, and is integrated with real life problems. First, motivational questions are the key to project learning. They must be specific and meaningful. Thirdly, students are the subject, and teachers only serve as guides to help them create situations, provide materials and participate in the evaluation of the whole process. Finally, the project comes from students' real life. Students can deal with challenges from the real world and solve problems in life with the knowledge they have learned [6].

3.2 The Design of Teaching Model

We have designed a new training mode of "1.5+1.5+0.5+0.5" for application-oriented undergraduate colleges and universities, and take the school-enterprise cooperation "characteristic class" as the teaching carrier.

In the first stage, 1.5 years of general education courses and basic professional courses will be studied. Case teaching method will be adopted to ensure that students have a solid foundation and the teaching will be completed by the teachers in the school.

In the second stage, 1.5 academic years of professional curriculum learning (simulation project implementation stage), a combination of "project-based" and "task-driven" teaching methods [7] is adopted. The enterprise engineering project is decomposed into sub-project modules, and different sub-projects are completed respectively. Finally, the project is integrated. Each sub-project module corresponds to 1-2 professional core courses. The completion process of each sub-project is divided into three steps. The first step is to conduct project analysis, the second step is to learn the knowledge required by the project, and the last step is to complete the project. "Teaching" as one of the teaching design, to ensure that students have a solid professional knowledge and professional skills, by the school teachers and enterprise engineers to complete the teaching;

The third stage, 0.5 academic year of professional training, complete the real enterprise research and development or production projects, from project investigation to project implementation in strict accordance with the standard process of enterprise engineering project implementation, student-oriented, teacher-assisted way, focus on training students' vocational skills, comprehensive training Combined with professional quality, engineering ability, school teachers and enterprise engineers to complete the teaching;

The fourth stage is the 0.5 academic year of enterprise internship and graduation design, students enter the enterprises and positions that match the major for practical practice.

The implementation carrier of this talent training mode is school-enterprise cooperation characteristic class [8], which integrates industrial resources, industry experience, research and development technology, engineering projects, internship positions and other development elements of the enterprise into characteristic class, and relies on teachers, teaching sites, experimental and practical training sites and rich social resources of colleges and universities to complete talent training. In characteristic classes, colleges and universities are mainly responsible for providing students with daily management, teaching of general education courses and specialized basic

courses, providing teaching sites, experimental and practical training sites and other services. The enterprise provides internship, engineering projects suitable for teaching, and project - based teaching. A set of teaching equipment, comprehensive quality relatively high engineers and other services. The universities and enterprises are jointly responsible for the teaching of professional practice and practical training courses, the exploration of project-based talent training mode, the formulation of talent training programs, the construction of project-based teaching laboratories and training bases, etc.

3.3 Design of Talent Training Program

The following is to take the major of electronic information engineering as an example, using the “intelligent greenhouse control system” of Beijing Wisteria Intelligent Agricultural Science and Technology Co., Ltd. as a teaching project, to detail the training mode of new engineering talents.

3.3.1 Design of Talent Training Objectives

Applied engineering talents are talents with good ideological and moral qualities, positive personality, generous and solid theoretical foundation, strong ability to use knowledge to solve problems, and can engage in experimental research, planning and design, processing and manufacturing, engineering application, technology development and other work in a certain field [9].

Applied engineering talents training target is emphasis on problem solving, innovation ability, cooperation ability, such as the core accomplishment, to adapt to the need of production, build and service, research and development, the theory knowledge to consolidate the wide caliber, professional knowledge emphasizes the applicability, the teaching process attaches great importance to the combination of theory and practice, attaches great importance to the training and skill training, teaching organizational employment oriented. We take electronic information engineering as an example to illustrate the training objectives of application-oriented engineering talents.

3.3.2 Design of Talent Training Process

School-enterprise special class is suitable for 20-30 people, divided into 4-6 project groups, with about 5 people in each group. The project team is the unit of project-based learning, which cooperates, helps, supervises and competes with each other. The specific talent training process is as follows:

Basic learning stage: This stage consists of three semesters, which is carried out in the way of daily class teaching. Case teaching and task-driven teaching are adopted to mainly complete the study of general courses, basic courses of specialty, introduction courses of specialty, basic courses of specialty and introduction courses of specialty, etc. Project simulation implementation stage: This stage lasts for three semesters, with learning groups as the unit, and teachers guide students to complete different tasks. First, the smart agriculture project is divided into five sub-projects, each of which corresponds to one or two professional practice courses or skills. The completion of each sub-project can be divided into three stages. The first stage is the cognition of the project, understanding the goal of the project, professional knowledge and skills needed to complete the project, etc. The second stage is the knowledge storage of the project, through case-driven way, the completion of professional practice courses or skills learning; The third stage is the implementation of the project, the teacher guides the students to complete the sub-project. Finally, the teacher guides the students to complete the integration and debugging of the system. Table 2 illustrates the simulation stage of the project based on the “Intelligent Greenhouse System” for the major of electronic information engineering. Project implementation phase: This phase will last for one semester. According to the real engineering project development process of the enterprise, the development and implementation of the engineering project will be completed with the study group as the unit, students as the leader and teachers as the assistant. The project development process includes project research, project planning, hardware and software system design, equipment procurement, project hardware and software system design and implementation, system integration and engineering

implementation, project report and summary. Enterprise engineering assistants and school teachers work together to complete the process of teaching and student evaluation.

3.3.3 Design of Talent Training Evaluation System

Change the previous single evaluation method, take the semester as the basic unit of assessment, to carry on the comprehensive ability assessment of students. Comprehensive ability score is used as the basis for participating in various kinds of evaluation, as well as the reference for students to recommend employment, and is eventually included in the students' personal files. Achievement assessment should be combined in three aspects: the combination of school evaluation and teacher evaluation, process evaluation and final evaluation, collective evaluation and individual evaluation. The comprehensive score is composed of two parts: the process evaluation score and the final evaluation score. The process evaluation score accounts for 70% and the final exam score accounts for 30%. The process evaluation is composed of students' self-evaluation, group evaluation and teacher evaluation. It is mainly based on students' learning attitude, project completion degree and group cooperation degree.

3.3.4 Design of Operation Mechanism of School-Enterprise Characteristic Classes

The training of new engineering talents is a long-term systematic project. The school-enterprise cooperation committee jointly established by the school and the enterprise leads the characteristic class. The school-enterprise cooperation committee shall guide the major issues, methods and progress of school-enterprise cooperation. In order to ensure the development of project-based teaching, teaching should be guaranteed from the following aspects:

3.3.4.1 Improve the Teaching and Engineering Skills of the Teaching Team

Enterprises and universities jointly carry out online and offline training for professional teachers 2-3 times a year, training professional knowledge, professional skills and engineering practice ability through different themes, so as to improve the professional teaching level and engineering practice ability of teachers.

3.3.4.2 Electronic Information Professional Skill Certification Cooperation

The school and enterprise will jointly develop a set of electronic information engineering professional skills certification system, students can obtain the corresponding vocational qualification certificate, employment support services after passing the certification. By introducing talent certification, students' graduation competitiveness, employment salary and high quality employment rate can be better improved.

3.3.4.3 Construction of Science and Technology Competition Laboratories

The electronic information competition laboratory is jointly built by the school and enterprises to promote the teaching reform, test the teaching effect, enhance the learning enthusiasm of students, and create an academic atmosphere and learning environment for the development of electronic information technology, so as to truly achieve the purpose of "promoting teaching, learning, reform and construction through competition".

3.3.4.4 Teaching Resources Construction

The school and enterprise will jointly develop teaching resources for the specialty of electronic information engineering. Taking ability training as the main line, practicability as the orientation, combining work with study as the approach, and vocational ability and professional ethics education as the core, they will constantly innovate and develop project-based teaching resources suitable for the cultivation of application-oriented engineering talents.

4. The Implementation and Effect of Project Teaching in Enterprise Engineering

Qilu Normal University and Beijing Wisteria Intelligent Agricultural Science and Technology

Co., Ltd., starting from strengthening students' professional practical skills and innovative ability, take the market demand as the guidance, boldly carry out reform on the training of engineering talents in application-oriented colleges and universities, and carry out the “1.5+1.5+0.5+0.5” type training mode of engineering talents. Based on the enterprise smart agriculture project, the university and enterprise jointly launched a new engineering project-based teaching, which is divided into four talent training links: “before the project implementation + project simulation implementation + project implementation + internship”, to cultivate outstanding knowledge-based engineering talents.

This new talent training mode lays emphasis on foundation, practice and practical effect. First, we should pay attention to the cultivation of college students' core qualities and integrate the cultivation of problem-solving ability, innovation ability and teamwork ability into all teaching links. Second, the theoretical basis should be consolidated to ensure that the students trained have strong professional theories and certain innovation ability. Third, strengthen experimental practice teaching links, increase the proportion and time of experimental practice teaching, pay attention to students' practical practice and professional skills quality training. Fourth, systematic training of engineering practice ability, based on the real practice projects of enterprises, through the simulation of engineering project implementation and engineering project practice two links of training, so that students have engineering practice ability and comprehensive vocational ability.

In the process of the implementation of the project, many aspects of talent training have been significantly improved, the results are very significant: First, students have a clear understanding of their major and future career; Second, students' learning enthusiasm and recognition of the major has been greatly improved; Third, students' practical ability and engineering ability have been greatly improved; Fourth, the ability of scientific and technological innovation of students has been greatly enhanced. The proportion of students participating in scientific and technological innovation competition and scientific and technological invention is much higher than that of ordinary classes.

References

- [1] Zhong Denghua. The Conception and Action of New Engineering Construction [J]. Research in Higher Engineering Education, 2017 (03) : 1-6.
- [2] Fudan Consensus on “New Engineering” Construction [J]. Research in Higher Engineering Education, 2017 (01) : 10-11
- [3] ”New Engineering” Construction Action Route: “Tianda Action” [J]. Research in Higher Engineering Education, 2017 (2) : 24-25.
- [4] The Guide to New Engineering Construction (Beijing Guide) [J]. Research in Higher Engineering Education, 2017 (04) : 20-21.
- [5] Yan Bingjie. Discussion on Practice Teaching Reform of Mechatronic Engineering Specialty Based on CDIO Concept under the New Engineering Background [J]. Science and Technology Wind 2019 (15) : 25.
- [6] Jiang Zihui. Research on Physics Teaching under STEM Education Concept [D]. Harbin Normal University, 2019
- [7] Wang Wei, Gong Chang. Research on project-based computer teaching methods [J]. Education Teaching Forum, 2016 (36) : 206-207. (in Chinese)
- [8] Li Wei, Ye Shulin, Hua Rui. Exploration of “3+1” training mode of engineering talents in local undergraduate colleges [J]. Higher Education Forum, 2017 (10) : 58-61.
- [9] QU Fu-cun, ZHOU Rong. Exploration and practice of engineering practical ability cultivation in application-oriented universities [J]. Education and Teaching Forum, 2018 (28) : 153-155.
- [10] Liao Minxia. Research and practice on the construction of quality evaluation system for application-oriented talents training [J]. Vocational Education Forum, 2016 (23) : 55-59.