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Discussion on the Training Mode of Outstanding Software Engineers in Application-Oriented Universities

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Abstract

In order to ensure the implementation of the training plan of "Outstanding Software Engineers Education", based on the concept of "deepening education and teaching reform, improving the quality of personnel training, adapting to the needs of social development, promoting the transformation and development of colleges, and embodying the characteristics of colleges", and with the guiding ideology of "reform mode, encouraging innovation, returning to engineering, and pursuing excellence", the concept of education and teaching is further changed, the concept of higher education actively serving the national strategic demand of "Jiangsu coastal development" and the concept of talent demand of enterprises in engineering education and service industries are established. Under the guidance of the national general standards and in accordance with the basic requirements of the professional standards of the industry, Yancheng teachers university actively explores and establishes the "3+1" school-enterprise cooperation mode, actively tries the school-enterprise cooperation system and mechanism conducive to the cultivation of "application-oriented outstanding engineers", reforms teaching methods, comprehensively improves students' engineering ability, pursues excellence in the cultivation of "application-oriented software engineers". This paper makes a detailed analysis and discussion on the training standards, professional curriculum training structure and school-enterprise cooperation training mode of application-oriented outstanding engineers in Yancheng teachers university.

Keywords

Applied Undergraduate, Excellent Software Engineer, Training Mode, School-Enterprise Cooperation

1. Introduction

Yancheng Teachers University is a new local undergraduate college, adhering to the "ability oriented, emphasis on application, industry oriented, service students" talent training reform direction. To highlight the "application type", to deepen the reform of the training mode of applied talents and to cultivate the talents needed and used by the local people; to improve the innovation ability of science and technology in the school, and to support the transformation and upgrading of the local industry [1]. Applied undergraduate is the most prominent feature and starting point for its practical application. The direction of education should take into account the significance of social development and the significance of the development of the subject [2].

In order to promote the application-oriented undergraduate teaching and cultivate students' engineering practice and innovation ability, it is urgent to join the training program of outstanding engineers. The education and training of excellent engineers, as the major reform project of the Ministry of education for the implementation of the national medium and long term education reform and development plan (2010-2020) and the national medium and long term plan for talent development (2010-2020 years), plans to use 10 years to cultivate more than a hundred thousand types of high-quality engineering and technical personnel for construction. The innovative country, realizing industrialization and modernization, lays the human resources superiority [3].

In June 2012, Yancheng Teachers University was identified

as a pilot university of "education and training program for excellent engineers (software)" in Jiangsu province [4] based on the concept of "deepening education and teaching reform, improving the quality of talent training, adapting to the needs of social development, promoting the transformation and development of the college, reflecting the characteristics of the colleges", the guiding ideology of "reform mode, encouraging innovation, returning to engineering, and pursuing excellence". In order to further reform the concept of education and teaching [5], to set up the concept of the national strategic needs of the" Jiangsu coastal development "by the initiative of higher education [6], to set up the concept of the needs of the talents of the enterprises in the engineering education service industry and to establish the new talent of the university and industry enterprises [7], mechanisms of reforming teaching methods, comprehensively improving the engineering ability of students in the "application-oriented software engineers" are steadily promoted.

2. Training Mode

In order to ensure the implementation of "excellent engineer (software) education training plan", Yancheng Teachers University actively explores the school enterprise cooperation mode of "3+1", and actively tries the system and mechanism of school enterprise cooperation which is beneficial to "applied excellent engineers". It has established a long-term and stable cooperative relationship with "Kunshan Zhong Chuang software engineering limited liability company, China soft international resource information technology Co., Ltd., Jiangsu Nanjing University Soviet Polytron Technologies Inc, Jiangsu Microsoft Technology Center (Wuxi) and Wuxi Hai Chuang Digital New Media Technology Co., Ltd."[8].

In the first three years of this model, the academic foundation, professional foundation, professional courses and related fields of knowledge are studied and cultivated in the school. In the last year，the cooperative enterprise is used to practice training for graduation design and so on. The opening form of independent teaching in a single professional course is broke, the real project of the enterprise into the software factory in the school introduced, and the integrated teaching reform activities in the direction of the professional direction is carried out. The educational reform movement of "return to engineering" has been carried out to build the engineering education background of "study environment enterprise, study content professionalization, ability training practical, effect evaluation specialization", and engineering talents' workplace environment is introduced with the aim to the industry training and application of excellence engineering talents. In addition, part of the curriculum design is carried out in the enterprise environment so as to make full use of the high quality resources of the enterprise, let the students understand the enterprise culture and the mode of operation, take part in the medium and short term technical training in the enterprise, let the students understand the technology, platform and tools of the frontier, and take part in the professional practice and graduation design to the enterprise as soon as possible from the enterprise, and it will be helpful to the change of students to professional people. School and enterprise will jointly establish talent training program, jointly determine the curriculum system and teaching content, the common implementation of teaching process, the common evaluation of teaching effect, sharing and co-construction of teaching resources platform [9].

Under the joint guidance of the school guidance teacher and the enterprise mentor, students learn at the enterprise training stage through practical learning links such as enterprise culture experience, enterprise introduction, and job rotation learning. The school standards for the training of outstanding engineers stipulate that the learning tasks and learning objectives of students in the enterprise learning stage are shown in the "enterprise training standards" and" outstanding engineers training plan-professional target realization matrix" in the annex. Under the guidance of the supervisor of the enterprise, students must think, observe, and discover problems in their work on the post. Based on this, they must draw up their own graduation project (thesis) and finish the graduation project (thesis) in combination with their actual work in the enterprise training stage. Therefore, enterprise training is based on working in the enterprise as a learning carrier, taking the topic selection and development of graduation design (thesis) as a starting point, systematically training students' comprehensive engineering ability under the environment of enterprise and social practice, and implementing the learning goal of cultivating outstanding engineers in the learning phase of enterprise [10].

3. Training Scheme

Based on the concept of Yancheng Teachers University and the orientation of personnel training, the scheme for training excellent software engineers in our school has been formulated. Through this scheme, students can apply the basic knowledge of science, mathematics and engineering related to the software engineering major. Students will owe the ability to analyze and solve problems in the software engineering specialty, and to master the personal and professional qualities related to the software engineering specialty, and to work and carry out in a multi-disciplinary team. [11].

On the basis of the CDIO project education program, the school and enterprise jointly formulate professional training programs: clearing training goals and requirements; setting up the main courses and special courses; determining the graduation standards, the academic system and the degree; setting up the curriculum distribution credits (especially the Extracurricular Research); giving the guide teaching process table; establishing the training standard ability matrix to examine the corresponding relationship between training objectives and curriculum. The content and time of enterprise learning and practice are arranged rationally, the convention of enterprise learning and practice is formulated, the evaluation standard of achievement in the learning stage of enterprises is formulated, and the comprehensive training project and

internship questions in the learning stage of the enterprise are designed. To ensure that students have a year or so to study in the enterprise, they will study the advanced technology and advanced enterprise culture of the enterprise, carry out the engineering practice, participate in the technological innovation and engineering development of the enterprise, and cultivate the professional spirit and professional ethics of the students [12]. The goal level map of the professional training is shown in Figure 1.

According to the training scheme of "software" Application- oriented excellent engineers, based on the CDIO engineering education program, the knowledge quality and ability requirements are implemented in a specific course according to the matrix corresponding to the matrix. Based on the principle of "wide caliber, thick foundation, stress practice" and "precise direction, attach importance to application and innovation", teaching content and teaching method are chosen. [13]

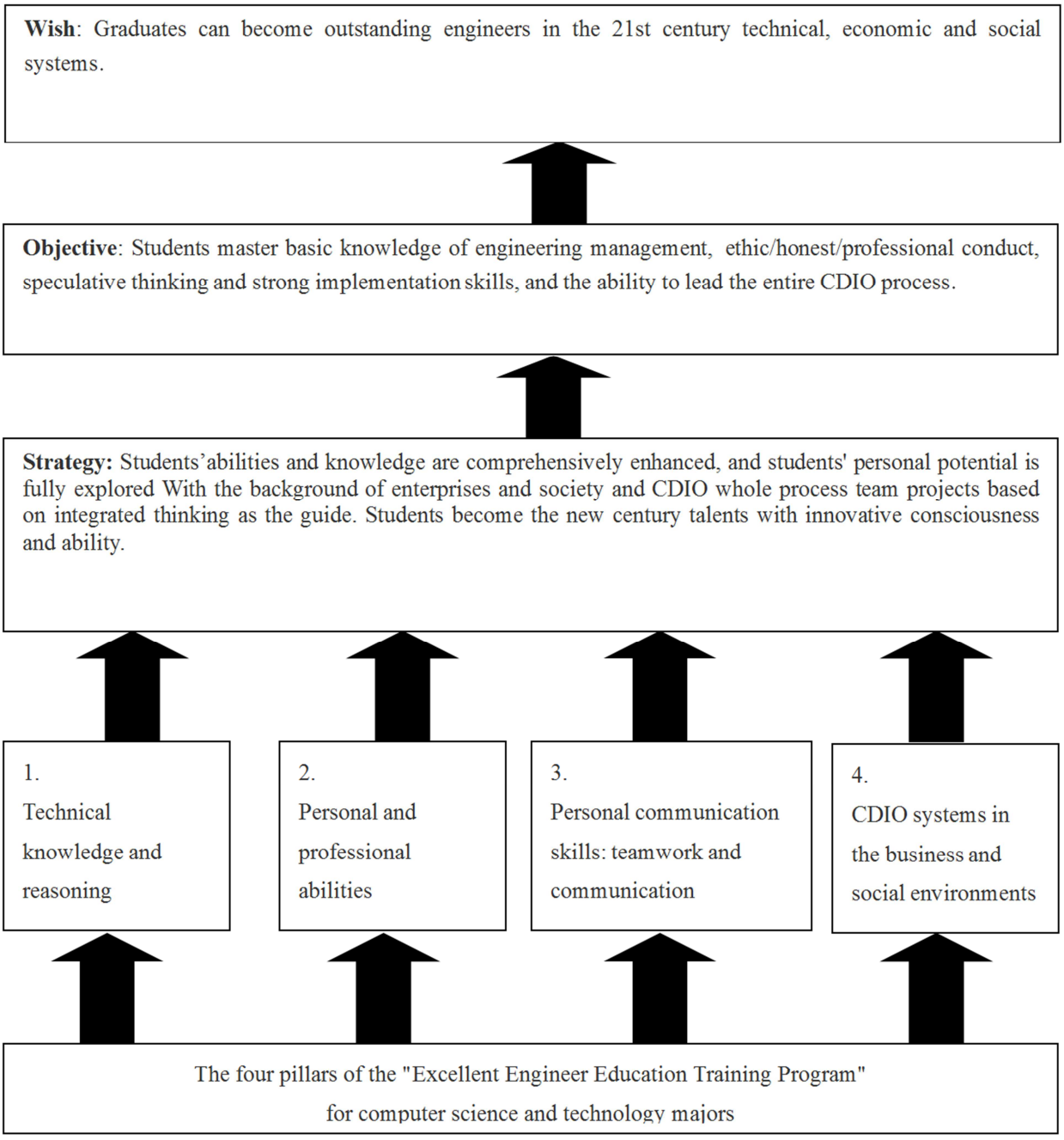

Figure 1. *Professional training target level map.*

The core curriculum system of software engineering specialty is constructed. The whole course is divided into six modules: basic course, core course, direction course, extended course, practice link and skill course. On the basis of establishing the research teaching experimentation area of the program design course and starting from the course of the basic program design, the research teaching reform of the program design class is started in an all-round way. On the

basis of the practice of the reform of program design course, some courses such as "program design foundation, object oriented program design, algorithm and data structure" are integrated, and the inner logic of "problem solving" and "calculation thinking" is taken as the main line, and the knowledge system of the above three courses is cut down and the course system of "problem solving" is constructed. In the training program, the "first level project (facing the professional system), the two level project (facing the curriculum group), the three level project (facing the specialty)" will reform the course system of the professional direction with the project-driven.

The first level project is the basic training of the program design. The related courses are the basis of the program design.

The second level project is the comprehensive design of software algorithm and the design of small digital system such as discrete mathematics, data structure, operating system, object-oriented programming and small digital system design. The related courses include digital logic, computer composition and structure, microcomputer principle and interface technology.

The third level project is information system design, software development comprehensive training and software test comprehensive training. The related courses of information system design include software engineering introduction, database system introduction, unified modeling language and design pattern. The related courses of software development comprehensive training have Web development foundation, software architecture and JavaEE oriented software development technology. Software testing training courses has software quality assurance, test frame, automatic measurement and test tools.

The following aspects should be considered in the setting of professional courses:

(1) Through the "professional ethics of engineers" course, as well as the "world engineers forum", growth salon, social practice and other activities and links, the study and training of outstanding engineers' professional ethics should be carried out.

(2) Through the tutorial system, the guidance of professors to students, especially in professional ethics, honesty and professional quality should be strengthen.

(3) The basic science (such as mathematics, physics, chemistry, etc.) and humanities courses should be strengthen, and the cultivation of mathematical analysis ability should be paid special attention so that students can lay a good mathematical foundation.

(4) All professional core courses in the form of curriculum groups should be organically combined to avoid duplication of contents among relevant courses, and avoid reducing teaching hours, and at the same time to facilitate teachers to impart professional knowledge in an organically linked way, and also to facilitate students to master knowledge flexibly. With the main goal of training students, they should master the ability to learn scientific knowledge, instead of simply inculcating the content of a certain subject. [14]

(5) Strengthening the cultivation of experiment and practical ability and adding experiment class hours to the courses can offer experiments, and incorporate the original unplanned experiments into the teaching plan, so that the experimental practice links can be better combined with classroom teaching.

(6) Through the team design of engineering projects, the cultivation of engineering design ability and cooperative work ability is highlighted, and the knowledge of engineering science is greatly broadened. Taking the concrete implementation of actual engineering projects as the main thread, the teaching process of specialized courses runs through, aiming at cultivating students' innovative consciousness and ability, the spirit of unity and cooperation and the style of study of integrating theory are practiced, strengthening the cultivation and training of students' engineering practice ability, and students' ability to carry out project design will be improved. [15]

(7) Encouraging teachers to interact with students in classroom teaching, inquiry-based discussion teaching is adopted.

The professional curriculum in the outstanding engineers training plan should reflect the following changes compared with the traditional professional curriculum in the past as follows:

The first is to strengthen the foundation of mathematical analysis, modeling and computer algorithm design so as to cultivate students' solid basic theories.

The second is to strengthen the position of the experimental link in the training system, to increase the experimental class hours in all courses that may offer experiments, to incorporate the experiments that were not originally planned into the teaching plan, to increase the class hours, and to allow students to practice in enterprises for a total of one whole year.

The third is to add a first-level project course. the first-level project will combine the actual operation of industrial projects to cultivate students' ability to design, and will innovate and work together with the system.

The fourth is to arrange team design projects to highlight the enhancement of collaborative work capabilities.

The fifth is to make full use of the summer semester to carry out the design and application promotion of software products so as to gain working experience.

The sixth is to incorporate professional lesson preparation into the teaching plan so that students can learn voluntarily and strengthen the training of students' self-study ability.

The seventh is that all graduation designs will use actual software projects and require students to really do the real project and cultivate their practical engineering work ability.

4. Conclusion

The school of information engineering of Yancheng Teachers University implements the school-enterprise cooperation mode of "3+1", introduces the concept of engineering education and research teaching, attaches great

importance to practical teaching and ability training, and tries to ensure "the comprehensive quality of the students, the individualization of training programs, the whole process of engineering practice and the diversification of the path of talent". In the education training scheme of "application-oriented outstanding engineer", point and surface are combined with the overall promotion of the reform of engineering education. Teaching is carried out to improve the quality of the training of application-oriented engineering talents, and to resolutely strike three cards of "school enterprise cooperation, engineering education, research teaching". The transformation of construction, teaching evaluation mechanism, student learning mode, practice teaching system and teaching management mechanism are implemented for talent training. Yancheng Teachers University is approved by Department of education, Department of commerce, Department of finance and other departments of Jiangsu province as: the construction point of the IT service outsourcing engineering practice education center, the pilot unit of training service outsourcing personnel in Jiangsu local colleges and universities. Yancheng Teachers University is also the training base of professional engineers of Jiangsu province software (computer science and technology, software engineering) and Jiangsu international service outsourcing talents.

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