

Construction of Bio-Engineering Comprehensive Experimental Teaching Innovation System

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Abstract

Analysis of the current situation and development prospects of need of bio-engineering professionals to build the education idea of social demand-oriented, “all for students, the whole process for educating people, all-round education,” take CDIO engineering education philosophy as the guiding ideology, practice curriculum system for the carrier, developing ability as the main line, to build an “innovative educational concept - Research theory Teaching - entrepreneurial practice Teaching - specialized personnel training,” experimental zone training model, developed with the appropriate professional teaching programs, course syllabus, experiments and practical syllabus. Talents experimental area constructed has achieved good teaching results.

Key words: Comprehensive experimental teaching; Bioengineering specialty; Creative spirit; Talent training mode; Experimentation area

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INTRODUCTION

Modern bio-engineering technology industry put forward new requirements for personnel: One requires knowledge, bio-engineering and technical personnel must possess multidisciplinary knowledge system; Secondly, capacity requirements, technical personnel must have a strong practical ability, innovation and development capacity. Thirdly, quality requirements, a strong overall quality and ability to make college students strengthen non-professional quality. So, how to build “Tech-bound” bio-engineering technology training model to make adaptation of needs of social development of the industry is a serious problem currently. In this paper to build a “polytechnic combined strength” bio-engineering innovative training model experimental zone.

1. STATUS OF DEMAND AND PROSPECTS OF BIOLOGICAL ENGINEERING PROFESSIONALS

In recent years, many colleges and universities begun to realize the disconnect between talent training and social demand and carried out some reforms, such as adding practical course, increasing the student training internship opportunities and so on, but it seems that these reforms have not much effect, because these reforms are still confined to the traditional education teaching idea and mode to instill knowledge for the purpose. In the long term, the undergraduate level education in Chinese university formed a system to master professional knowledge of discipline culture orientation as the talent, and make knowledge production as the goal, to discipline knowledge as a tool of education teaching mode, it weighs the system of subject knowledge but light social demand which lead to heavy knowledge teaching and light ability.

Under the environment of exam oriented education, pay much attention to standard of subject knowledge and academic values, but do not pay attention to the drawbacks of the actual ability that is to train students in practical skills and to solve the problems in field capacity is weak, lack of occupation quality and work adaptation period is too long. What the era of popular education society needs most is the construction of the economic and social service personnel. To have practice skills, occupation quality, post adaptability, to have the scene of problem oriented solving ability demand is in an important position.

In developed countries, senior technicians and technicians, senior workers, intermediate primary industry proportion is 35:50:15, and the results of a sample survey of China's coastal provinces is 2:4:94. Figures show that single goal exists in academic oriented training target, the structural contradiction of talent supply and demand is very prominent. Our forward from the human resources great nation to the powerful country of human resources needs to change to the consumption of resources, pollution of the environment at the expense of economic growth mode, all of those need high quality workers. But the public education in colleges and universities is not equal to the mode and School of ordinary occupation education training, training should not be limited to skilled workers. Public education is not to abandon the elite education, but also to the "elite education" in popular education platform, so that can promote certain aspects of the talent and let potential students pay attention to talent showing itself in the comprehensive development of students, so that can meet with strong professional interests and learning needs urgent hope to continue the deep of students. Especially in the process of education, should be social and business needs and education combination process. The ordinary university public education target should develop high-tech research personnel to enterprise application and technological innovative talents of undergraduate students. This is the only way to train social talents needed in ordinary colleges and universities, but also the ordinary university for social enterprises to cultivate talents, an effective way to serve the local economy.

With the transformation of business model from labor-intensive to high-tech, businesses need not be a simple technical operation workers, but workers that master high-tech, high-level production, management, complex talent services. Therefore, education reform must be market-oriented, enterprise demand-oriented training model.

The innovative experiment area will make the combination of our school with blue and yellow bioengineering companies of Shandong Province and pharmaceutical companies to carry out the bio-engineering and technical personnel training model reform of "Tech combines strength".

2. IDEAS AND REFORM POSITIONING OF TALENT TRAINING MODE

2.1 Take CDIO Engineering Education in Philosophy as a Guide

Experimental area is current bio-engineering industry development and industry professionals demand-oriented, taking practical engineering as background and engineering technology as the main line, learn and absorb advanced international CDIO engineering education concepts and standards and the entire CDIO process of product development that concluding Conceive, Design, Implement and Operate as the carrier, and the whole process of the project life cycle as the carrier to develop students engineering capabilities, student work ethic, academic knowledge and application of knowledge to solve practical problems ability, as well as with lifelong learning and team communication skills.

2.2 With "a Masterstroke, Three Enhanced" Teaching Philosophy

A main line means "combine basics and practice application to the whole process of personnel training, improve students' practical ability to innovate, develop biotechnology business needs of innovative talents"; Three strengthen means "strengthening the basics of teaching services in practice application of the concept of " to strengthen the idea of teaching service application "strengthen practice innovation ability." Fully utilize and integrate the overall advantages of college, jointly establish a multi-disciplinary combination of inside and outside, combining teaching and research, science and engineering, to build biological engineering training model innovation experimental area.

From the traditional mode of higher education in China's view, science professional personnel training emphasis on the basis of comprehensive, Culture form of "classroom activity test", cultivate talents of solid foundation of engineering professional; professional focus on the application, students "strong technology, knowledge system of weak, Imitation strong, weak imitation creation". 1999 college entrance examination enrollment expansion, more school-age population to accept the higher education into the University, engineering education and training in practice is weakened, the personnel training on knowledge as the center, gliding "classroom -activity-test" cultivation mode, has serious deficiencies in the cultivation of innovative ability, practical ability, team cooperation ability and enterprise cohesion with the engineering practice, far, can not effectively students engineering quality and comprehensive skills. To this end we gradually established a new idea of "Combination of science and Engineering, Discipline penetration, comprehensive development, enhance the strength". In the training mode

of innovative biological personnel, in accordance with the basic principles of “thick foundation, heavy ability, innovation, can start an undertaking”, system design talents.

2.3 Technological Integration, Ability Complex Training Ideas

Experimental Zone establish four cooperation platform. Lukang Pharmaceutical co-culture platform Luyin, Yanjing Group, Jiu Bao Sheng Xin cooperation platform, KongSheng and LanShan cooperative training platform, bioengineering excellent platform for personnel training (academic mode); set up four specialized curriculum Unit, respectively for four majors. Develop student's personality, cultivate innovative talents.

2.3.1 Technological Integration, Ability as First Principles

Core educational philosophy of experimental area is to develop students' ability to research and engineering practice, this includes not only theoretical knowledge and professional skills, but also the students' lifelong learning, innovation, team communication skills and the ability to control biological engineering systems. Emphasis on improving sustainable development potential talent; focus on analytical skills and problem-solving skills, communication and organization and coordination, the ability to take the initiative to acquire knowledge, management ability to project, competition ability, so to train high-level, high-quality bio-engineering and technical personnels.

2.3.2 Break Training Bottleneck, Internal and External Alliances Mode

The experimental zone innovative training school model for 3 years, firstly strengthen cooperative education, absorbs bio-engineering industry experts to participate in training program development, progress and acceptance of outcome of training. Secondly is to strengthen the practice teaching and business cooperation to establish training bases, and develop a rapid feedback mechanism for the employment needs of businesses, using “learning by doing” and “project-driven” teaching methods, training engineers to meet the bio-engineering industry needs.

Make combination of teachers of full-time and part-time, on campus and off-campus employment system, focusing on bio-engineering industry experience of teachers, hire the first-line engineers from industry and businesses as part-time teachers involved in the teaching process. Establish a full-time teacher training mechanism to understand industry needs, accumulate teaching experience and to achieve vocational qualification certificates and industry certifications.

2.3.3 Training System Integration

Talents training system integration means the integration of basic theory of biological engineering, application development and engineering technology, and integration

of courses test, vocational qualification certificate examination and assessment and industry certificate training. Integration of personnel training reflect the guiding ideology of experimental zone “ability promotion, wide adaptation”, which guarantee the advanced age of biological engineering and technical personnel. That supports the development of local bio-engineering industry with many types of special courses group construction, multi-level enterprises cooperation, multi-style innovation activities of students and other engineering practice as a means to construct three-dimensional training system, training of diverse talents include: biological engineering research innovative talents, engineering and technology innovation, applicative and innovative talents, service management, product marketing, innovation and human resources. Through innovative talents experimental zone to provide multi-level bio-engineering and technical personnel for the society.

3. DESIGN OF EXPERIMENTAL ZONE BUILDING

3.1 Curriculum Mode

Implementation “6 + X + Y” Curriculum program, 6 means 6 subjects basic courses uniform set, namely zoology, botany, microbiology, chemical engineering principles, genetics, biochemistry. X is project-based segment includes fermentation engineering, cell biological engineering, genetic engineering, molecular biology engineering, enzyme engineering, etc., in order to form a biological engineering, technical course group; Y is professional electives. Freshmen in the first two school years learn the same basic course to master the basics of life, medicine, environment, materials, energy and other related fields to enhance Science foundation; at the end, determine achievement profession. In the second year we will open foundation disciplines, bioengineering basic course, expanding horizons of Science and Technology and Engineering to cultivate students' ability to identify and solve problems, teamwork, innovation and professional quality so that they dare to take risks; In the third year we will open bio-engineering foundation courses, specialized courses, comprehensive experimental design, engineering design, at the end of the semester, the students voluntarily enter training firms for a summer holiday. Student will work, do summer social practice and professional practice to create flexible time to complete the training module courses. In the fourth year students have to complete professional orientation courses, internships, training and graduation, under the guidance of professional teachers student will act one or two kinds of roles to play in a real biological engineering production and development projects, which requires a scheme of arrangement in accordance with the student.

In the process of designing specialized curriculum system, make full use of the research results of modern biological engineering education at home and abroad. Through periodic enterprise needs questionnaire, school enterprise forum, visited the graduates way widely collect enterprise talent demand information, combined with the national and Shandong Province, blue and yellow economic policy documents, according to the evolution of technology and the industry development trend, make clear the orientation of talent cultivation, adjust the curriculum and professional training direction, forming a curriculum system and flexible the teaching plan, strengthening the students' self-study, guiding thinking, inspiration of innovation.

3.2 Establishment of an Integrated Professional Training Mode "Learning & Research"

Implementing the concept of "social services, service enterprises" to strengthen school-enterprise cooperation and establish long-term mechanism to achieve market integration training objectives, so that students learn by doing.

3.2.1 Experiment Module

a) base module (Bio-based experiments, biological engineering experimental basis); b) improvement module (simulation, specialized test); c) Research Module (integrated practice, graduation design of experiments).

3.2.2 Training Module

The main training project: a) security, protection training room; b) fermentation training room; c) molecular biology training room; d) cell engineering training room; e) purification training room; f) biopharmaceutical training room; g) real breeding training room; h) enzyme engineering training room; i) instrumental training room.

3.2.3 Practice Modules

The main practical content: a) beer unit; b) antibiotics device; c) protein drug device; d) sewage treatment systems; e) drugs and intermediates production processes; f) crude distillation unit; g) natural product extraction process; etc..

3.2.4 Graduation Modules

Conduct of scientific research project for factories, schools, teachers and technical staff and research engineering of firms act as graduate design instructor of students.

In addition, students go to the enterprises stagely, move the classroom into the workshop to make on-site instruction, learning while practice and applications. Take full advantage of the modern enterprise equipment and very practical engineering and technical personnel, truly combining theoretical knowledge and practical industrial production.

3.3 Build a Comprehensive, Open Practice Teaching System

Highlight "three-pronged": practical aspects of internal and external courses combination, engineering training of

internal and external combination of campus, hardware construction of combination of production, study and research. Achieve "four characteristics": practical content characteristic, extracurricular practice standardization, research facilities servicing teaching, engineering training actually. We have to effectively use the existing resources, meanwhile, actively use rich social curriculum resources and digital technology and cultural resources to form a big platform of the combination of basic and frontier, theoretical and experimental, real and virtual, on and off campus. Create college exploratory learning lab.

Students are encouraged to use the summer holiday to participate in professional practice and increase undergraduate fund to encourage the active participation of 2,3 grade undergraduate to do research activities of teachers and give some funding support. Open basic laboratory to a larger area to meet the student re-improved demand for basic operations or synthesis experiments; research and development of experimental research for freedom choice for students and to leave room for further innovation and research; open research Laboratory to a greater extent to ensure that more students can do "innovative experiments optional project" experiment.

CONCLUSION

a) Achieve the Personnel Goal of "Thick Foundation, Strong Strength"

Experimentation area relying on the College of life science, resources superiority and the fine traditions of the school, the education teaching idea, curriculum, education reform of teaching methods, practice teaching and other aspects of argumentation, design training plan. Implementing "1+1+ elastic1+ elastic 1" training mode, professional foundation courses by subject categories through engineering students, enhance scientific knowledge and scientific knowledge reserve width and thickness, paving the way for the sustainable development of science literacy.

b) Construction of "Polytechnic Combination Type" Biological Engineering Senior Personnel Is Productive.

The teaching team construction is the basis of the subject development and is the fundamental guarantee for construction specialty. College taking "the introduction of talent, talent strategy is working to improve in part-time", focusing on the construction of associated schools, school enterprise joint compound teaching team. The initial formation of the basic disciplines of biological engineering characteristic subject application of biotechnology to highlight the advantages of advantages and characteristics of subjects; establish melting combination of downstream, and the domestic and foreign research production with combined support system as one of the biological science and technology to get high-quality personnel training.

c) Construction of Experimentation Area Teaching Resources Makes Great Achievements

Based on the original practice base, and successively and Yanjing group Sankong brewery, Shandong Lukang Pharmaceutical Group, Tai An Jiu Bao Shengxin Biological Engineering Co Ltd, Yantai Luyin Pharmaceutical Company Limited, Rizhao City Arashiyama food and drug industry park company cooperation, as school of biological engineering major practice training platform. According to the promotion of the use of case teaching in experimentation area need, curriculum experiment and project practice case library construction has already started.

d) Experimental Zone foster innovation culture results of exploration

38 students participated students challenge cup of national college contest in the past two years, and 60 students participated the National Students' Mathematical Contest in Modeling in the past two years, bio-engineering design contest, bio-engineering experiments skills competition of Shandong Province. The students attend the annual "Qufu Normal University undergraduate research project" and other activities as an opportunity, in 2010 the student have research papers published, two have won the college "Challenge Cup" award in Shandong Province, and a number of other provincial awards. Students trained there have strong innovation abilities; we develop the potential of the best students, so that many employers, universities and research institutes give commendable voice.

Although innovative training model experimental area achieved excellent results in practice in recent years, but it focuses on the ability to develop professional applications and technological innovation ability. With the deepening of the practice, we need to have the confidence to further improve the experimental area, build "all for students, the whole process for educating people, all-round education," take CDIO engineering education philosophy as the guiding ideology, to build "an innovative educational

concept - Research Theory Teaching - Entrepreneurial Practice Teaching - Specialized personnel training," training system, developed with the appropriate professional teaching plan , course syllabus, experiments and practical syllabus. Educate students to adapt to local economic construction and social development needs, life goals clear, solid theoretical foundation, full of practical ability, engineering and technology-based biotechnology research talents.

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