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A Research on "Trinity" Curriculum Design Reform Based on Application-oriented Institutions

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Abstract. This paper takes electronic information science and technology major as an example and illustrates how the application-oriented institutions set up the personnel training program, how they grasp the curriculum content to highlight the characteristics of undergraduate education, and to distinguish with higher vocational education. The paper proposed that the personnel training program should satisfy the social needs and promote student's sustainable development on the basis of the professional features. The curriculum design should follow the "trace back from the exit" principle, namely the best-needed professions first, then the certificates these professions required, and last the curriculums designed for students to prepare for the certificates; briefly speaking, professions, certificates, and curriculum, these three key factors are the "trinity" in curriculum design. The final purpose of reform in curriculum design is to stress "practice" in undergraduate education, to ease the undergraduates' employment crisis.

Background and Significance of Transformation of Application-oriented Institutions

Background of Transformation of Application-oriented Institutions. On May 2, 2014, the State Council promulgated *A Decision on Accelerating the Vocational Education Development* and proposed to guide a number of regular undergraduate institutions to transform to application-oriented ones, shifting their focus to undergraduate vocational education. On March 5, 2015, premier Li Keqiang proposed to guide part of the local undergraduate colleges and universities to transform to application-oriented ones in his work report. On March 5,2016, this proposal was raised again in the government work report: to promote the qualified institutions to transform to application-oriented ones. To transform is a highlight in current institutions' development, but the issues such as why to transform, what to transform, where turn to , how to transform and who to transform, need in-depth exploration and rational thinking[1]. It is an urgent task to answer these questions and solve these problems the government, higher institutions and the academia have encountered. Xi'an Fanyi university(XFU), a non-governmental university, has been approved by Shaanxi Education Department as the first pilot university. The reform is imperative but how to conduct the pedagogical program reform is still in constant exploration.

Significance of Transformation of Application-oriented Institutions. The talent standard of the new century depends on the quantity of knowledge, but also on the innovation ability. The traditional engineering mode of education values more on students' mastery of professional knowledge, rather than engineering practice ability or innovation ability. As for engineering application-oriented undergraduate colleges and universities, they should actively explore with new practical teaching methods and further research in cultivating students' practical and innovative ability. Applied undergraduate institutions are required to guarantee the capable, accessible and qualified trainees for the employers; meanwhile to ensure the sustainable development of the trainees. If the traditional undergraduate education is to cultivate talents for the "future", applied vocational for the "present", then applied undergraduate education is not only for "present", but also taking into account of the "future"[2].

Current Situation of XFU's Transformation to Be Application-oriented

The transformation and reform have been on their way; meanwhile, the further guidance documents and policy have been issued. In 2015, Xi'an Fanyi University has revised the personnel training program (2016 edition) under this new situation. As to this university, the transformation asks for macro theoretical guidance, but more, the specific training programs, curriculum systems, and pedagogical content to support. Although the revision of the personnel training program has been initially completed, the corresponding supporting measures like curriculum syllabus and teaching content have not yet been implemented. How to reform the curriculum system and teaching content, we still have no experience to learn from.

Main Problems in Existing Curriculum System

The key point to transformation is the curriculum design. Some institutions try to cut the curriculum budget, and usually set up relatively less costly specialties, such as engineering and science. This uneven course structure doesn't accord with the state's economic and industrial structure. The priority of the reform is to adjust the specialty setting.

The core of transformation is the personnel training mode, as the cultivation of applied talents differs greatly from that of the academic ones. The cultivation of academic talents often weighs on students' ability to convert the law in the field of natural science and social science into scientific principles; while the cultivation of applied talents lays more emphasis on practice on the assembly line, and conducts more practical teaching activities, such as experimental teaching and production practice, for students to grasp the relevant professional knowledge and skill.

Application-oriented undergraduate education, emerging with the integration of science, technology and production, has long existed in developed countries and regions, like engineering and technical education in the United States and four-year higher vocational education in Germany. To accord with the talent view in the 21st Century, the newly emerged application-oriented undergraduate education in China should be oriented by society and occupational market and establish the corresponding quality concept to meet the needs of society and the students.

Main Problems in Experimental Curriculum Design

(1) The experimental goal does not meet the requirements of applied talents. The traditional experimental teaching goal emphasizes the verification of the known theories and conclusions, to cultivate students' multi-disciplinary experimental ability; and application-oriented experimental teaching objectives should be the improvement of students' practical ability, brain power and innovation [3].

(2) The experimental content does not adapt to the need of talent cultivation, nor arouse students' interest. According to some applied engineering colleges' experimental curriculum design in Shaanxi province, the comprehensive and designed experimental courses is not more than 20%; some verification experiments are old-fashioned; a lot of experiments were arranged after the related theory teaching, which largely makes the experimental training a supplementary means for the theory teaching and reduces the students' enthusiasm in learning in a passive way [4].

(3) Teaching methods cannot satisfy the cultivation of application-oriented personnel. Some experimental teaching methods and means appear relatively old-fashioned; some teachers in application-oriented institutions are still weak in experimental teaching reform awareness, poor in modern educational technology and lack of capability of establishing the experimental teaching auxiliary software to adapt to the teaching reform [5].

(4) The experimental teaching conditions are not suitable to the large-scale input of the experimental equipment. Some newly-established applied undergraduate colleges and universities continue to expand the scale of enrollment year by year and the investments in every aspect increased as well; but the fact is that with the continuous deepening of higher education reform, the state will not support in all aspect. Therefore, these colleges and universities ought to solve their own problem in lab construction and purchase of equipment [6].

The Possible Reasons for the Problems in Experimental Curriculum Design

(1) Slow change of concept. Most application-oriented undergraduate colleges and universities are formed and upgraded in recent years. [5] The long-formed, uneven resource distribution and small scale of school make the experimental teaching in an “overlooked position”, which results in the difficulty to implement and improve the experimental teaching [7].

(2) The unclear policy orientation. The college basic courses are unified examinations mostly within a certain range and the teaching separates with testing. Due to the horizontal comparison, the college basic courses gain more attention. The professional experimental courses, however, composed of electives, are mostly assessed and receive insufficient attention from policy makers and students [8].

(3) The insufficient on-and-off-campus training base. Since the implementation of the new higher education management system, some colleges and universities cut off the ties to the original cooperating corporations; the connection between school and enterprise is not close as before which brings difficulties to the construction of off-campus base and the practice arrangement for students.

Application-oriented undergraduate institutions should apply the application theory into the whole teaching process to enhance students' practical ability. XFU used to set curriculum and personnel training targets for undergraduates as “weigh on solid foundation, seek diverse professions” and “rich theory, poor practice”, following the personnel training mold and curriculum design for the governmental colleges and universities. What students learn in school are rich but loose, extensive but theoretical, and has little to do with their future employment. After graduation, students from the traditional institutions encounter the tense competition in employment; however, they are always weak in handling this situation to get a job due to their poor capability in practice, skill deficiency and lack of occupational qualifications. The deep-rooted reason for students’ employment failure lays in the improperly-set training target and false curriculum design in school. The effective and powerful reform on pedagogical program are appealed for to ease the employment crisis.

Here, the paper takes the specialty of electronic information science and technology in XFU as an example to illustrate the construction of "Trinity" curriculum system, an effective system for schools to adjust their training targets and curriculum.

Curriculum System Construction for Electronic Information Science and Technology

Professions for Telecommunication Students. In the information technology and microelectronics industry development seminar 2014, the minister Wu Jichuan, from Ministry of Industry and Information Technology, said, “the next 10 years is a critical period of development of the microelectronics industry in China; the government will foster microelectronics industry as a priority.” Information technology has been affecting the strength of economic development, while the electronics industry plays a decisive role in the military field. In recent years, professions suitable for the undergraduates majoring in telecommunication are listed as below [9]:

(1) Information processing technology
(2) Professional hardware design
(3) PCB design and application
(4) Embedded hardware development
(5) FPGA design and application
(6) Communication design and application
(7) Electronic information professional education
(8) Industrial production and automation
(9) Innovation and entrepreneurship

Occupational Qualifications Telecommunication Students Obtain after Graduation

(1) Information processing technician certificate

The qualification certificate of computer and software technology proficiency is issued by department of human resources and social security with the national authentication and high recognition.

(2) Electronic design engineer qualification certificate (EDP)

Electronic design engineer qualification certificate (EDP), with peer and social recognition, is introduced by the Chinese institute of electronics (CIE) in order to meet the needs of society for electronic design engineers. The certification sticks to open, fair and equitable principles; it is with high standards, identifying beholder's ability and pursuing social acceptance and international recognition [10].

There lately are two certification tests for EDP: Electronic design engineer certification test and board level design junior engineer certification test. These two tests separately include junior and assistant levels. Since 2012, the intermediate and senior ones began to be certified.

(3) Network engineer qualification certificate

Network engineer qualification is an intermediate-leveled one in the qualification certificate of computer and software technology proficiency, including three levels: network administrator, network engineer and senior network plan designer.

(4) ARM engineer qualification certificate

After identification, ARM issues AAE certification to the applicants, with high peer recognition.

(5) Telecommunication technician qualification certificate

Telecommunication technician qualification certificate, a national vocational qualification certificate, is presented by ministry of industry and information technology, with three levels: assistant telecommunications engineers, telecommunications engineers and senior telecommunications engineers. Its testing scope and objectives include telecommunication engineering personnel from all telecommunication operators and other enterprises and institutions.

(6) Electronic information engineer certificate

After the skill appraisal and identification, the registered occupation qualification certificate is issued by the national certification center with the embossed seal of JYPC (Jiangsu Yingcai Professional Certification Limited). It is authoritative and popular certificate with national and state recognition, including three levels: assistant electronic information engineer, electronic information engineer and senior electronic information engineer.

(7) Teacher qualification certificate

Teacher qualification certificate is the license of teachers in educational field. From the year 2015, anyone who wants to be teachers should take this national exam and then apply for teacher qualification certificate.

(8) Automation engineer

Automation engineer qualification certificate, with broad research scope and application prospect, is issued by department of human resources and social security. Automation engineer qualification certificate guarantees its bearer a relatively good employment. In addition, anyone who obtain this certificate can also work in teaching or research field.

"Trinity" Curriculum System

Table 1 Trinity curriculum system

Construction of Efficient Practical Teaching

Future Profession	Qualification Required	Supporting Curriculum
Information Processing Technology	Information Processing Technician Certificate	Information Processing Technology
Hardware Circuit Design	Electronic Design Engineer Certificate	Circuit Theory, Analog Circuit, Digital Circuit, Electronic Measurement, Signal And System, Electrical Control And Plc, Scm Theory And Application, Digital Signal Processing, Sensor Principle And Application
PCB design		
FPGA design		
Embedded Development	ARM Engineer Qualification Certificate	ARM Embedded Application, Digital Circuit, C Language Programming
Telecommunication Design	Telecommunication Engineer Qualification Certificate	Telecommunication Theory, Mobile Telecommunication
Network Technique	Network Engineer Qualification Certificate	Computer Network Technology, Information Processing Technology, C Language Programming
Industry And Automation	Automation Engineer Certificate	ARM Embedded Application, Electrical Control And PLC, Circuit Analysis, Automatic Control Theory, Process Control System, Sensor Theory And Application
Business Consultant	Certificate Of Entrepreneurship Business Consultant	Innovation And Entrepreneurship Guidance

(1) Construction of Experimental Teaching System

The new experimental teaching system should break down the traditional curriculum pattern, adding experiments for one specific course, displinary experiments, self-designed experiment and scientific innovation experiments in order to cultivate the trainees with "knowledge, ability and training quality”. In the personnel training program for electronic information science and technology majors in XFU, strict rules were set to every single experiment to be practical, designable, and favorable for the cultivation of its trainees.

(2) Open up of the Laboratory

Laboratory should be open to students to change the past patterns for experiments which sticks strictly to the experimental instructions, methodology and procedures. These open-up and breakdown measures would allow students to put forward their experimental subjects, to make their own experimental plan and to conduct and verify their own experimental hypothesis. Some students from Science and Technology school, XFU, are permitted to participate in the teacher’s subject project, and regularly organized to implement the competitions related to small inventions and small production. All of these, is to cultivate students' engineering consciousness, innovative spirit and practical abilities. With the relatively well-set experimental condition, 24/7 open hours and a special trail room for all the students interested in electronic design to do the experiments for the contests, the open-up of the laboratory provides with a hatch place for students with a scientific dream in chests.

(3)The Training Base Construction

According to the training objectives of applied undergraduates, the regional, industrial, economic and social development, and the technical and occupational requirements, the on and off campus

training bases should be carefully planned and then well-constructed. The on-campus training base can be set according to the professional types, and invites enterprises to participate in the design and construction to ensure good training simulation; the off-campus base construction should be paid attention to its overall planning, resources sharing, and the avoidance of repeated construction. The electronic information science and technology major in XFU has been connected to three enterprises for a long-term base practice in a very stable way.

In order to highlight XFU's featured personnel training mold "professional + foreign language + innovative entrepreneurial skills" for non-foreign language majors, the curriculum for foreign language have been consistent for almost 4 years. Under the current circumstances of public entrepreneurship and innovation, the innovation and entrepreneurship courses are added to the curriculum design. In class hour, on the basis of "appropriate theory, rich practice; different from vocational education" principle, it is strongly recommended that the practice proportion in curriculum design should be around 35% of the total. The professional practice courses for telecommunication students from XFU takes up 34.72%.

Summary

As an education concept, the application-oriented education has been proposed not long, but it is a trend to the development of the times [11]. The application-oriented reform has already started in some colleges and universities and these higher institutions are groping forward, trying to find a proper talent training program to cope with their own problems. XFU has basically completed the revision of professional personnel training program, including the program in electronic information science and technology. The construction of curriculum system, examined and supervised by professionals and expertise in-and-out of campus, accords comparatively with the training objectives. Practice is the best policy, and the newly constructed personnel training curriculum system will stand the test of practice.

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