

# **The Construction of “Three-Three-Three Models” in Applied Technical Talent Training under the Background of Emerging Engineering Education**

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**Keywords:** Training, Applied Technical Talent, Emerging Engineering Education

**Abstract:** The emerging engineering education put higher requirements on the comprehensive qualities and professional capacities of technical talents, as well as their innovative spirit and integration competence. The education of engineering applied talents should focus on interdisciplinary and practical contents, since diversification and innovation are extremely important for high level engineering practical talents.

## **1. Introduction**

The development of emerging engineering education should follow the requirements of “Fudan Consensus”, “Action Route for the Development of Emerging Engineering Education” and “Guidelines for the Development of Emerging Engineering Education”. These regulations clearly express the idea of emerging engineering education, provide the direction of disciplinary development and the guidance for specific operation, and reflect the authority’s understanding on the new situation. The layout of emerging engineering education needs to be improved from perspectives of discipline and specialty arrangement, as well as the design of teaching contents, teaching plans and teaching methods, so as to meet the needs of personnel training and engineering course development.

The emerging engineering education should try to meet the demand of industrial development, rather than follow the “discipline-oriented” principle. Segmented subjects should be integrated and achieve interdisciplinary cooperation, in order to achieve the transition from serving the industry to leading industry development. Colleges and universities are the cradle of talent cultivation; they must take the strategic development of our country as the requirement and goal, and take the actual needs of industries and enterprises into consideration, so as to deepen higher engineering education reform. The construction of new subjects should be promoted from diversified methods, multiple channels and different directions.

## **2. New Requirements for Applied Technical Talents under the Background of Emerging Engineering Education**

Under the background of emerging engineering education, application-oriented undergraduate education should cultivate talents who have research and development abilities as well as compound-type capacities, and are able to meet the needs of emerging industrial development. The goal is to cultivate applied technique-oriented professionals into excellent engineers with international and sustainable competitiveness.

### **2.1 New definition of applied technical talents under the background of emerging engineering education**

We must clearly recognize that the training of engineering and technical personnel should be carried out from the two aspects of “experts” and “general talents”. “Experts” are familiar with their own professional fields, have professional spirit and attitude, can meet the requirements of the new economy and different new industries, and are able to solve problems with their professional abilities. In order to achieve these targets, we need to construct the training mode of engineering education combined with the cultivation of individual spirit and professional abilities. General

talents have relevant professional knowledge and corresponding professional competence, and can cope with complex and changing social environment and social status, since they have comprehensive innovation and integration abilities.

As the main body of applied talents training, technology-applied universities undertake the responsibility of engineering education reform. But they cannot only rely on their own strength. Colleges and universities need the support from government departments, as well as the participation of the whole society include teachers and students, in order to achieve joint efforts and create a new engineering education community with mutual benefits.

## **2.2 Training of applied technical talents under the background of emerging engineering education**

The cultivation of applied technology talents under the background of emerging engineering education can be achieved progressively from following five levels. We should firmly adhere to the new concept of engineering education, construct new subject requirements and structures, reconstruct personnel training modes, clarify new teaching standards and classify the new training system. Universities from different levels should participate and train different applied technical talents according to their characteristics. Through these measures, the quality of engineering education can be improved to meet the demands of future engineering development.

From above discussion, it can be found that under the background of new engineering education, colleges and universities must gradually change the traditional development methods, and try to achieve the integration of different disciplines. From the perspective of development direction, colleges and universities should build a multi-disciplinary and multi-professional training platform, as well as a multi-disciplinary communication platform, so as to promote the collaboration of secondary teaching units. From the perspective of curriculum setting, the school authority should focus on the diversified choices of students, provide them with courses from wide-ranging of subjects, consolidate basic curriculum modules, and emphasize general education to increase students' knowledge on social sciences. Optional courses should be offered for students, in order to provide them with more choices. Students can choose lessons according to their own needs. Finally, from the perspective of training methods, comprehensive research projects should be actively carried out. Teachers should encourage students in these projects, since they can work together with students from different specialties. The school should also attach importance to the cultivation of compound and professional engineering and technical talents. [7]

## **3. The Construction of “Three Models” in the Training of Applied Talents under the Background of Emerging Engineering Education**

At present, colleges and universities are more closely linked with local regions. The development of colleges and universities can promote local development. At the same time, the support of local policies and the development of regional culture and economy can also support the construction of colleges and universities. Therefore, it can be seen that under the background of emerging engineering education, the cultivation of applied technical talents should be integrated into local development. The quality of personnel training should be improved to meet the requirements of regional development, so as to achieve the mutual promotion between universities and local governments, and reach the target of common development. [8]

### **3.1 Construction of the “four modules” for applied technical talent training with the aim of strengthening moral education and cultivating people**

According to the requirements of the current occupational classification system, namely the specific requirements of O\*NET (Occupational Information Network), the applied technical talent training model is constructed in Figure 1.

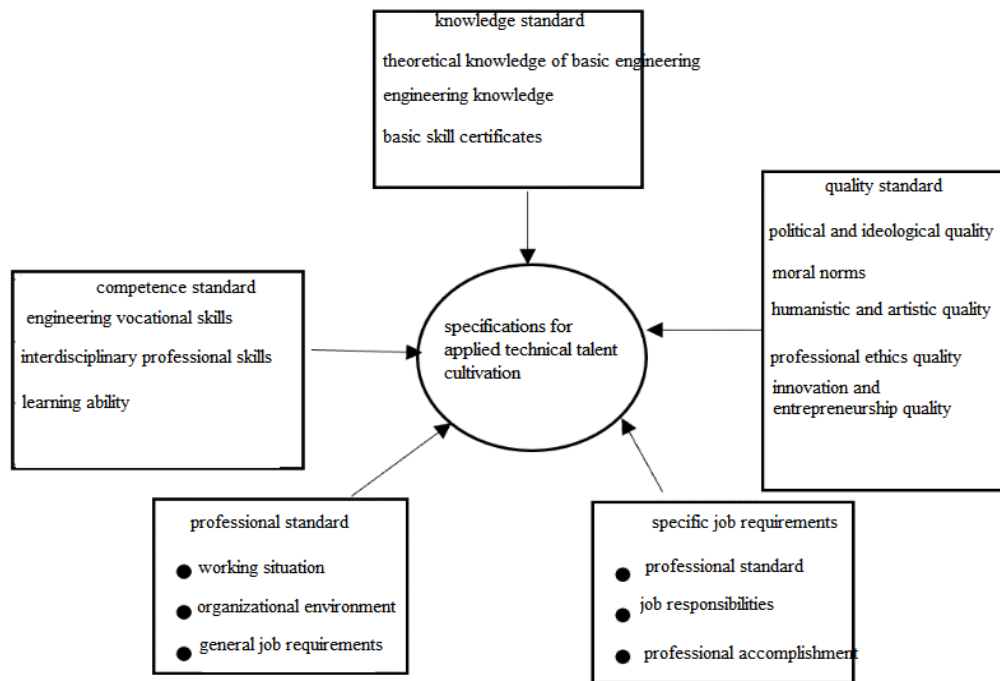


Figure 1. Specification model of applied technical talent cultivation

The ability structures of applied technical talents are analyzed according to the connotation of “specifications for applied technical talent training”, as well as the characteristics of students from different sources. The training system is designed from the aspects of personality accomplishment, basic discipline knowledge, basic technical skills and advanced engineering technology. These “four modules” are esign of “four modules” training structure highlights the “technical” characteristic of applied technical talents. It can also create “layered objectives” and achieve the goal of “educating people according to their features”.

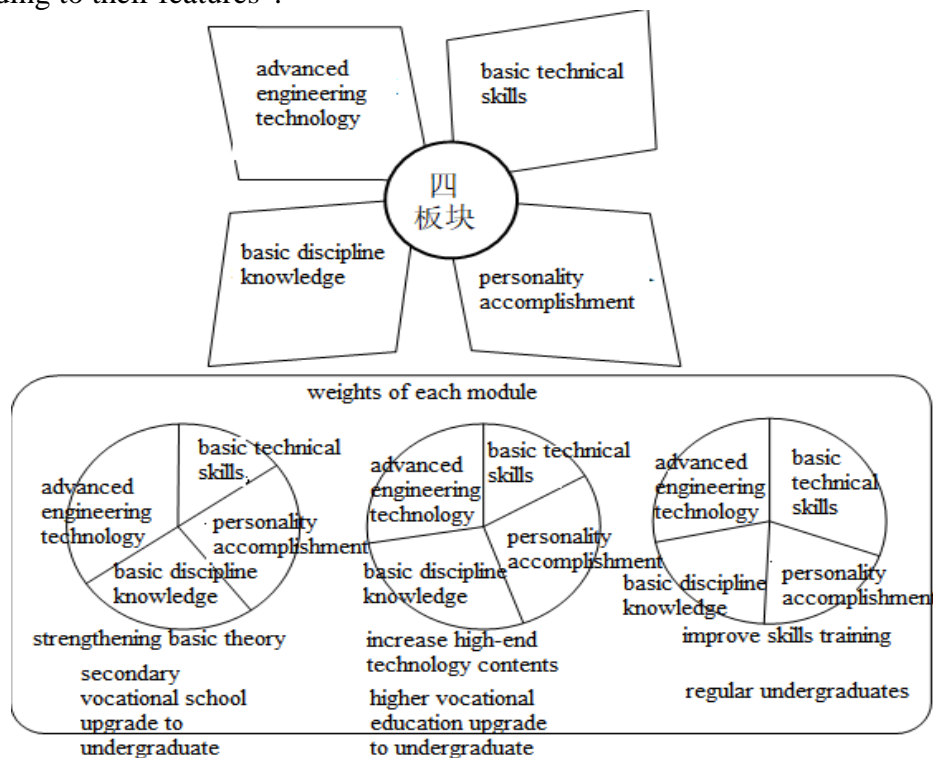


Figure 2. Different weights of “four modules” and the cultivation of talents from different sources

By adjusting the weights of “four modules” and teaching students in accordance with their aptitude, a curriculum system is formed for students from different sources and with different

characteristics. The system achieves differences in training process and consistency in training objectives.

Through the adaptive adjustment of the weights of each module in the “four modules”, we can not only find the different objectives in the hierarchical training, and ensure the common requirements for ability training. The applied technical talent training model which highlights the “technical” feature in training objectives, specifications, teaching environment and process and quality assurance mechanism is created. The model achieves difference in the training process and consistency in training objectives.

### **3.2 Construction of applied technical talent training model from three levels**

#### **3.2.1 Macro-level: constructing applied technical talent training model with the distinct “technical” feature**

The theory of “technological structure” pays attention to the adaptability of technical talents to industrial development and the importance of all-round development. Therefore, the applied technical talent training mode should highlight the “technical” characteristic in training objectives and specifications, in teaching environment and process, and in the quality assurance mechanism. Under the background of emerging engineering education, the training goal of applied technical talents is high-end engineering and technical personnel. With the theory of personnel training specifications as the theoretical framework, four different modules are designed from the perspective of curriculum to realize the cultivation of technology applied talents.

#### **3.2.2 Medium-level: reconstructing the “four modules” and integrating the “double systems” in curriculum**

According to the idea of “four modules”, the corresponding curriculum system is determined. In terms of curriculum content, courses in the system can be divided into theoretical courses and experimental training courses. Then the reconstructed curriculum model of theoretical curriculum system and experimental training curriculum system is established as the integration of “double systems”. In this system, the objective of theoretical curriculum system is to satisfy the requirements of technical posts. The theoretical system is composed of a series of courses and contents after decomposition, optimization and integration. The experimental training curriculum system is composed of the “micro teaching” of basic experimental platform and small comprehensive training and the “micro enterprise” which combines virtual and practical companies. Through the medium-level curriculum system layout, corresponding professional training programs can be comprehensively revised to solidify reform fruits. It can solve the problems of insufficient curriculum integration, isolated courses and the insufficient integration of theory and practice.

#### **3.2.3 Micro-level: providing the technical ability cultivation environment based on the idea of curriculum integration and “double micro” introduction**

In the process of course design, we should pay attention to the implementation of ideological and political education, integrate necessary contents to improve the non-technical abilities of engineering and technical personnel, compile textbooks and design related courses based on the professional qualities of engineers, and carry out online and offline practices inside and outside classroom on the basis of “E-class” and innovative practice platform to improve the personality qualities and comprehensive accomplishment of college students. Through these measures, we can promote the all-round development of students. Meanwhile, we also need to promote the integration of “basic technical skills” curriculum, implement the integration of theory and corresponding practical courses, create corresponding “basic experimental cloud platform” and “micro teaching” platforms, so as to support the systematic integration of school curriculum. [9] “Advanced engineering technology” curriculum should also be integrated. The enterprise curriculum should be introduced to realize the school-enterprise curriculum reform. The application of virtual and real “micro-enterprises” and the guidance of tutors from “the school and enterprises” in internship and graduation projects can improve the abilities of students in applying high-end engineering

technology, and realize the curriculum integration as well as the construction of an integrated platform group.

To sum up, under the guidance of the objectives and ideas of applied technical talent training, the top-level design of applied technical talent training mode with “technical feature” is realized from macro, medium and micro levels and on the basis of the comprehensive development of human beings.

### **3.3 Improving three training mechanisms to achieve the objectives of applied technical talent training**

(1) Cultivating the technical characteristics of applied technical talents with the technological structure theory as the objective mechanism. The technical requirements of applied technical talents are stipulated. In the personnel training mode, we should pay attention to technical literacy and analyze it from three important dimensions: technical knowledge, technical ability as well as the technological thinking modes and behaviors. According to the “four modules” structure and the highlighted “technical” characteristic, the design idea of “double systems” integration should be implemented to realize the curriculum system integrated with “theoretical curriculum modules and practice links”.

(2) Strengthening the interaction between teachers and students and promote the realization of curriculum through the dynamic mechanism of “double teachers” team building. To cultivate applied technical talents with engineering technological thinking modes, it is necessary to build a team with “double teachers” with craftsmanship spirit. Teachers can set the teaching environment similar with the workplace situation and help students to gain experience according to the requirements of posts. The collaborative education can be achieved through the deep integration of schools and enterprises. In the actual training process, the integrated module of theoretical courses should cultivate students with technical skills which can meet the requirements of employment; corresponding experimental training platform should also be built to promote the integration of theoretical courses and experimental training curriculum system in the teaching process. The comprehensively revised training program can solidify reform achievements. By guiding teachers’ behaviors in specific teaching activities in theoretical teaching and experimental training courses, we can ensure the implementation of “double systems” teaching mode deep integrated with teaching methods. Finally, we can introduce enterprises into the curriculum module. Through bringing in excellent skilled technicians from enterprises, we can make sure the implementation of “double systems” teaching mode deep integrated with teaching methods and teaching staff. In the process of teaching, the joint participation of school and enterprise can help to realize the blending of school and enterprise culture.

(3) Establishing the quality assurance system based on the teaching quality assurance mechanism of “closed-loop inside school” and “opening to the society outside school”. In the process of training, the parallel teaching quality assurance system of “individual monitoring”, “closed-loop inside school” and “opening to the society outside school” should be established. A supporting “opening to the society outside school” quality monitoring system allows enterprises to participate in the monitoring network. Through classroom teaching, examination paper evaluation, quality evaluation, process supervision, teacher-student discussion and other means, the process of personalized cultivation of different types of students is highlighted, monitored and analyzed; the feedback can go back to various teaching links. In the process of implementation, “individual monitoring” is focused; students personal information files are constructed. Then students’ information is classified through database. In the process of training, relevant data alters with students’ performances. Through the circulation mechanism of comparison, evaluation and feedback, students’ individual learning processes are tracked throughout the process. Problems can be found and analyzed to provide reference for students’ career planning and growth goal setting. Thus, the system can better serve the personnel training process.

The core of the emerging engineering education reform is to establish a talent training model oriented to meet the needs of industry. On one hand, it cultivates students’ innovation and

entrepreneurship abilities. On the other hand, it sets up a full-cycle engineering education concept so as to gradually realize the transformation from following to leading the development of international higher education. At present, the fourth industrial revolution unfolds at an exponential speed. Faced with the tide of digital economy and intelligent manufacturing, only by cultivating applied technical engineering talents, actively adjusting higher education structure and developing new frontier disciplines and specialties can we truly realize the transformation from traditional economy to new economy, and realize the goal of transforming human capital structure in regions and the country as a whole.

## **Acknowledgements**

Fund Project: This paper is supported by the Foundation for Undergraduate Higher Education Reform Projects of Guangxi Province in 2018 (Project No.: 2018JGA304). It is also supported by the Foundation of “Space Culture Research Centre”, which is a key humanities and social science research base for colleges and universities in Guangxi Province. (Project No.: 2018HY07).

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