

# Research on the Mode and Practical Operation Mechanism of New Engineering Education in Local Colleges and Universities

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**Abstract:** Local colleges and universities are important places for training new subject talents. On the basis of new understanding and response to the development of new industries in the future, local colleges and universities urgently need to carry out new reforms on the traditional education mode, curriculum system and education system. Based on the current situation of the new subject education mode in local colleges and universities, this paper analyses the existing problems and their causes of the new subject education mode in local colleges and universities. By comparing the operation mechanism of the innovative development of the new subject education mode in some existing colleges and universities, the effective operation mode of the new subject education in some local colleges and universities were summarized, which can achieve the training of new engineering innovative talents, support and implement the objectives of the national development strategy for new industries.

**Keywords:** new engineering; education mode; local colleges and universities

## 1. Introduction

At present, with the rapid development of Internet and intelligent technology and the wide application of IT+intelligent technology, the pace of scientific and technological innovation has been accelerated, a new round of industrial revolution has been promoted, and today's knowledge economy has been pushed forward. In response to the new round of technological and industrial revolution, countries around the world have made new strategic plans, such as Reindustrialization in the United States, Industry 4.0 in Germany, and Made in China 2025 in China. With the rapid development of Internet and intelligent technology, higher education education project is facing a subversive challenge. The new challenge requires innovating the concept of higher education from a strategic height, actively carrying out relevant policy research, and promoting the construction of disciplines and talents training mode of higher education. Therefore, since 2016, engineering education with the theme of new engineering has been gradually carried out during the discussion, we have successively

reached such documents as Fudan consensus [1], Tianda action [2], and Beijing Guide [3], which marks the beginning of a new chapter in the reform of new engineering Education in China. But this is only the leading document of Engineering Education in China. The design and implementation of new engineering education path and method, but also need to carry out a more detailed feasibility study, so as to create an effective talent training mode.

Local colleges and universities are important places to cultivate new engineering talents. On the basis of a new understanding and response to the development of new industries in the future, local colleges and universities urgently need to carry out new reforms on the traditional education mode, curriculum system and education system, so as to cultivate new engineering innovative talents and support and implement the national development strategy of new industries. Therefore, it is necessary to analyze the disadvantages of the new engineering education mode in local colleges and universities, so as to explore the new engineering education mode and promote the implementation and development of the new engineering education mode.

## 2. Research Status of New Engineering at Home and Abroad

Gu Peihua [4] defined new engineering as innovation on the basis of interdisciplinary integration of different disciplines, so as to form new disciplines and new fields, then created new concepts of engineering education with new paradigm. Based on the new requirements of the future new economic industry for engineering and technical personnel, Wu Aihua et al. [5] put forward the overall design route of building new engineering. Zhong Denghua [6] put forward new requirements for the challenges of new engineering from the perspective of national development needs. On the basis of discussing the innovative connotation of new engineering and engineering education, Zhao Ji et al. [7] put forward the problems that need to be solved in the new engineering education, and elaborated the problems that need to be solved in the innovative engineering education. Lin Jian [8] put forward the concept of new engineering from the perspective of skill requirements of current engineering application talents and talent requirements of future

industrial revolution. Lu Guodong [9] explored and designed the new engineering construction path and ideas to meet the needs of economic construction and development. Xu Lei et al. [10] expounded the connotation of future new engineering construction and development from the perspective of science and engineering innovation and application. Chen Hui et al. [11] through the analysis of the current comprehensive university talent training advantages, targeted design of these universities with high-quality resources how to promote the development path of new engineering construction. Xia Jianguo et al. [12] put forward the development plan of new engineering construction in local colleges and universities on the basis of analyzing the local demand for new engineering talents. Shi Xiaoqi et al. [13] creatively put forward the new engineering education system on the basis of analyzing the demand of new industrial technology for talents. Ye Min et al. [14] designed a new education paradigm and education system based on the comparative analysis of the education concept, specialty setting and talent training of science and engineering, combined with the talent demand of the future new industry, and the construction of the education concept, specialty setting and curriculum system of the future new engineering talents. Wang Juhong et al. [15] took Tencent as an example to explore school enterprise collaborative education under the background of new industrial economy, and put forward the path of new ecological construction.

### 3. Analysis on the Current Situation of New Engineering Education Mode in Local Colleges and Universities

#### 3.1. The Contradiction between the Supply Side of Talents and the Demand Side of Talents in Emerging Industries

The specialty setting of colleges and universities directly affects the quality of talents in Colleges and universities. The quality of specialty setting determines the scale of running a school and the quality of education. The enrollment expansion policy of the Ministry of education has greatly promoted the leapfrog development of local colleges and universities, resulting in the doubling of the scale of colleges and universities and the number of students. But in recent years, with the rapid development of IT technology, the demand for talents of some technology enterprises has changed a lot. Due to the lack of innovation motivation and real-time research in the major setting of most colleges, the trained undergraduate graduates can not meet the demand of the talent market in the new era, which directly leads to the low fit between the trained talents and the industrial demand, resulting in the contradiction between the talent supply side and the demand side. It is mainly manifested in the following aspects: (1) Being lack of market research and scientific argumentation, the specialty setting is shown to be blind to a certain extent; (2) Due to the construction of professional investment being far

from keeping up with the rapid development of the professional, the quality of professional personnel training is difficult to be guaranteed; (3) Being unreasonable professional structure, the development of the local economy is not enough which is difficult to meet the demand; (4) Due to the lack of full construction and mining of professional connotation, characteristic specialty and brand specialty are lacking; (5) Being lack of leading figures to lead the professional construction, the professional construction level is difficult to be improved; (6) Due to the situation of emphasizing professional setting and neglecting professional construction, the professional construction is lack of effective process management.

#### 3.2. Lack of Synchronized Implementation System Guarantee among School Enterprise Collaborative Education Mechanism with Collaborative Development of Industry, University, Research and Education

Local colleges and universities provide technical solutions to solve the problems of enterprises, thus enriching the teaching resources and strengthening the combination of practice and teaching. Effective school enterprise cooperation projects can enrich the teaching content and scientific research. For the enterprise, the enterprise will provide the advanced equipment and funds needed by the school in scientific research and the internship positions of students, so as to enrich the teaching and research resources of the school and realize the win-win situation between the school and the enterprise. However, in the training of new engineering talents, there is a cross-border nature, which makes the local colleges and universities have inherent deficiencies in the process of new engineering talents training. Due to the failure to reflect the new technology and process of industrial production in the teaching content, the optimization of the knowledge system of some engineering majors lags behind the development of industrial technology and industry, resulting in the serious dislocation of talent supply and demand. Therefore, the establishment of industry university research collaborative development mechanism to ensure the synchronous implementation of school enterprise collaborative education is a major measure to ensure that new engineering talents adapt to the needs of industrial development.

#### 3.3. The Development Concept of New Engineering Department in China Lags behind the International Engineering Education Concept

International engineering education such as Washington Agreement advocates students as the basis, focusing on the development of students' comprehensive ability, which is a guiding concept that adapts to the needs of talents in the new round of industrial revolution and technology update, which is completely divorced from the previous engineering talent education concept. The concept is based on the needs of industrial talents. Based on the students' ability to apply knowledge, professional

analysis ability, ability to solve engineering problems, system design and development ability, sustainable development ability and social morality and responsibility awareness ability, the concept focuses on solving the students' employment quickly according to their professional ability and has strong social adaptability. The formulation of these indicators has direct guiding effect on the cultivation of new engineering talents in China. It can be said that it is a directional concept and thinking, which can guide the cultivation of talents in Higher Engineering Education in China under the background of a new industrial revolution. Through analyzing the domestic higher engineering education to the new engineering training concept, it has certain innovation, but there is still a certain gap with the consistency of the talent training objectives of the Washington Agreement. In particular, how to cultivate the comprehensive professional ability of graduates, promote the graduates to have a strong employment ability, so as to truly implement the new concept of student development oriented [16].

#### **4. The Innovation and Development Mechanism of the New Engineering Education Mode in Some Universities**

##### **4.1. Hunan Institute of Engineering Establishes a System for Training Excellent Engineering and Technical Talents of "New Engineering Department"**

###### *4.1.1. Based on the demand of talents in new engineering industry, the multi-agent cooperative education mechanism is innovated*

Hunan Institute of engineering was approved in June 2010 as the first batch of "excellent engineer education and training program" Pilot Universities of the Ministry of education. In the process of training excellent engineering and technical talents, they have been exploring and innovating constantly, and gradually forming a unique "innovative multi-agent collaborative education mechanism". It has innovated the "3+1" school enterprise joint training mode based on "one core, two main bodies and step by step" (1) "one core" focuses on the cultivation of students' practical and innovative ability; (2) "Two subjects" mainly refers to the two subjects that the school and the enterprise participate in training students together, and realize the improvement of students' professional practical ability through the cooperation between the school and the enterprise; (3) "Step by step" mainly refers to the theoretical study of the students in the previous three years, entering the enterprise for the rotation internship in the fourth year, and participating in the enterprise engineering project design and process training, and graduation design project of this project. Under the guidance of school tutor and enterprise tutor, the enterprise project design is carried out, so as to improve the students' ability of professional analysis and problem solving through the practice of enterprise project.

###### *4.1.2. Connecting the regional and industrial chain closely, and further optimize the discipline system*

In order to ensure the quality of outstanding engineering and technical personnel, Hunan Institute of engineering has implemented a series of guarantee measures: (1) further optimize the discipline system based on the development of new engineering industry. To construct the construction and development platform of "big majors" such as electrical and energy, electronic information, equipment manufacturing, chemical and textile materials, accelerate the transformation of traditional engineering majors with the theme of intelligent manufacturing and green development, and further optimize the discipline system; (2) to formulate 17 policy documents such as "implementation measures of" excellence plan "of Hunan Institute of Engineering". We have set up special funds for specialty construction, teaching staff, practice base, student development and textbook construction, and set up special funds for enterprise learning of "excellence program" of 3000 yuan per student per year; (3) we have optimized the implementation of professional talent training program of "excellence program". According to the requirements of Engineering Education Accreditation under the background of new engineering, the curriculum syllabus and examination syllabus of "excellence program" are formulated, so as to realize the following: 1) the transformation from "teaching centered" to "learning centered"; 2) the modularization of general education is conducive to the achievement of knowledge, ability and quality; 3) the integration of innovation education into the whole process of talent training and the strengthening of the second classroom link To achieve the combination of in class training and extracurricular practice, pay attention to the cultivation of personalized learning ability.

###### *4.1.3. Based on the cultivation of engineering ability and engineering literacy, build a school enterprise shared practice and innovation platform*

Hunan Institute of engineering is in line with international engineering education and carries out personnel training according to the standards of international engineering education. Its mechanical design, manufacturing and automation major has passed the professional certification of engineering education, becoming the first local university in Hunan Province to pass the professional certification. Its "excellent class" students have won the National College Students' science and technology innovation team - "Xiaoping science and technology innovation team" and other awards. In order to train students' engineering ability and improve students' engineering literacy more effectively, the school carries out a very effective school enterprise joint training mode, establishing joint research institute, joint technology R & D center and collaborative innovation center with enterprises respectively, building a high-level shared practice and innovation platform, providing students with a high-level innovation platform, improving students' practical ability and problem-solving ability So as to

ensure the quality of engineering ability training and engineering literacy training of Engineering application-oriented talents under the background of new engineering.

#### 4.2. Guangdong University of Technology Constructs a New Engineering Training Mode for Diversified Innovative Talents

##### 4.2.1. *Integrating innovation resources and build innovation and entrepreneurship education mode*

At present, Guangdong University of technology has seven outstanding engineer education and training programs of the Ministry of education, and has won the honorary title of "deepening innovation and entrepreneurship education reform model university" in 2016. The school started the innovation and entrepreneurship education mode by effectively gathering innovation resources. (1) Gather high-end talent resources. Through the construction of effective talent introduction and incentive mechanism, the introduction of international and domestic high-end academic resources and international and domestic high-level talents, to provide strong teachers for the training of new engineering talents; (2) The implementation of project-based teaching. Starting from the major needs of Guangdong's new round of industrial transformation, we should build school enterprise cooperation projects and implement school enterprise cooperation project teaching, so as to provide a powerful platform for cultivating students' professional practice ability; (3) Integrate resources and cultivate innovative talents. Guangdong University of technology is good at integrating multi-disciplinary resources in specialty setting and personnel training plan, so as to implement interdisciplinary and multi professional innovative personnel training.

##### 4.2.2. *Highlight the educational function and build a multi-party collaborative innovation platform*

Guangdong University of technology integrates resources through school leading and government enterprise cooperation, so as to achieve win-win sharing and smoothly implement the training of engineering talents. (1) Build collaborative education platform. Through the mode of government and enterprise investment and school led operation, we should integrate international advanced and high-end resources and jointly build a collaborative education platform; (2) Deep integration with industry. Through the project provided by Guangzhou National IC base and Hunan Design Institute, government funding and providing venues, the project is deeply integrated with the industry, and the project training is implemented, so as to solve the problem of insufficient teaching resources; (3) Multi professional integration training talents. Through the master studio, school enterprise joint training class and other training methods, on the basis of project teaching, multi professional integration is carried out, so as to carry out an effective team training mode.

##### 4.2.3. *Interdisciplinary integration and exploration of multi professional integration training mode*

Guangdong University of technology, through the reform of curriculum system and implementation mode, implements the multi-disciplinary and multi professional integration training mode in the process of personnel training. (1) The curriculum is multi-disciplinary integration. Every student should not only be trained by the core courses of the major, but also master the thinking methods of the major. At the same time, carry out multi-disciplinary integration design project, communicate with different majors, understand the thinking methods of other majors, so as to establish a more open professional thinking method; (2) Implement multi-disciplinary integration. Through the integration of overseas high-quality resources and industrial resources, we can provide a variety of teachers, and also provide a multi-level practice platform for project teaching; (3) Build a project teaching platform. Through cooperation with enterprises, the establishment of school enterprise cooperation platform, in the teaching process, the implementation of multi professional integration organization teaching. Guided by the project, students are led to form a team to carry out project research and development, so as to effectively guarantee the teaching quality of industry education integration.

#### 4.3. "School + Enterprise" Education Mode Designed by Jiangxi University of Technology

##### 4.3.1. *Building a new education mode of "school + enterprise" guided by needs*

How to cultivate applied talents to adapt to the development of society, which requires schools to control the quality of talent training. Jiangxi University of science and technology attaches great importance to the cultivation of students' engineering practice ability. The school regards promoting school enterprise collaborative education as the key node of engineering education reform, and puts forward and implements a new mode of "3 + 1" school enterprise collaborative education. In the first three years of the University, engineering students mainly complete the basic theoretical study in the school, and in the last year, they complete the final enterprise internship and graduation design in relevant enterprises, so as to realize the driving of enterprise development to talent demand the guiding role of collaborative education. With the joint efforts of teachers and students, the school has been approved as a national experimental area of innovative talent training mode.

##### 4.3.2. *Based on mutual benefit, build a new mechanism of two-way flow between school and enterprise*

Jiangxi University of science and technology has established more than 160 enterprise practice bases, four national engineering practice education centers, six national excellence program pilot majors, and seven provincial excellence program pilot majors. Not only students need to participate in enterprise practice, but also

teachers need to participate in engineering training in enterprises, especially young engineering teachers, who must have more than half a year of enterprise engineering training experience in five years. In order to promote closer cooperation and exchange between schools and enterprises, enterprises will send technical backbones to schools for lectures according to the needs of schools, so that enterprise personnel can participate in the whole process of talent training, and promote the development of school enterprise collaborative education mode. Enterprises are able to obtain the talents they need, and schools have also improved the level of running schools, achieving the goal of mutual benefit.

#### 4.3.3. Building a new platform for school enterprise cooperation and education with the project as the link

Through the establishment of R & D platform in enterprises, Jiangxi University of science and technology not only solves the practical technical problems of enterprises, but also cultivates students' project practice ability. Through close cooperation with Zhangyuan tungsten company, Professor Wan Linsheng of the university has carried out pioneering research on the process theory of ion exchange and chemical crystallization of tungsten and molybdenum smelting. His research achievements have won the second prize of national science and technology progress award twice. In order to solve the current shortage of talents in smart grid technology, Jiangxi University of science and technology and Taihao group established the Jiangli Taihao smart grid experimental class. Based on the OBE education concept, the experimental class used goal oriented and course content optimization methods, project driven and flipped classroom methods to cultivate students' learning ability. At the same time, the enterprise and the school jointly design the curriculum content and experimental projects, and jointly build the smart grid laboratory with the school. The school employs excellent enterprise engineers to teach the practical courses, curriculum design and graduation design of smart grid engineering. The school sends excellent teachers to the enterprise for guidance, so as to truly realize the goal of school enterprise cooperation and collaborative education Purpose.

## 5. Conclusions

### 5.1. Integrating Teaching Resources and Explore the Mode of Multi Specialty Integration

A new round of industrial revolution has changed the demand for industrial talents. The design and implementation of each new project need talents with different professional backgrounds to cooperate with each other, so the talent training mode under the background of new engineering also needs to be reformed accordingly. Therefore, colleges and universities need to integrate high-quality teaching resources in the process of personnel training, and strive to improve the quality of teaching and learning. When cultivating students' professional core competence,

colleges and universities require students to participate in interdisciplinary projects and learn the thinking methods of different majors, so that they can analyze and solve project problems from different angles and different professional directions, so as to meet the needs of today's new engineering compound engineering talents.

### 5.2. Building the Education Platform of School Government Enterprise Association and Implement the Project-based Education Mode

Through the establishment of school government enterprise collaborative education mechanism, making full use of government enterprise platform resources, using collaborative education project, leading students to participate in project work, these measures can effectively cultivate students' professional practice ability, and promote students to have the professional ability to adapt to the future position in advance. The use of school government enterprise project teaching not only enriches the teaching means and methods, but also improves the teaching effect and quality, and cultivates the professional ability of graduates.

The main contradiction in today's society is the contradiction between the growing needs of the people for a better life and the unbalanced and inadequate development. New engineering education faces the same contradiction, that is, the contradiction between the increasing demand for new industry talents and the lag of new engineering talents training mode in Colleges and universities. With the rapid development of Internet and intelligent technology, it promotes a new round of industrial revolution. It needs compound engineering talents to adapt to the new industry. However, some colleges and universities have not updated their professional settings in time, and some talent training plans even stagnate. Therefore, how to build an effective personnel training mechanism to effectively meet the needs of compound engineering application-oriented talents is an urgent problem for colleges and universities. Only by creating more effective new engineering education mode and cultivating qualified new engineering compound applied talents, can we effectively cope with the new round of science and technology and industrial revolution and gradually realize the dream of a powerful country in higher education.

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