

## On the talent training mode of “new engineering” in local undergraduate colleges

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**Abstract:** With the development of China's new economy and emerging industries, new engineering construction comes into being. Facing the construction of new engineering, local undergraduate colleges and universities should deeply understand their own development trend, clarify the training mode of new engineering talents, and take the adjustment of specialty setting guided by regional industrial demand, the innovation of talent training mode based on the consensus of coordinated development, and the improvement of talent training quality as the main measures for local undergraduate colleges and universities to cultivate new engineering talents

**Key words:** local; New engineering; Talent training mode

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The development of China's new economy and emerging industries needs a large number of higher engineering education talents who can adapt to its development, while the traditional engineering education is facing the problem of disconnection from the development of the new economy. In order to solve this problem, the construction of "new engineering" should be born at the right time. It requires colleges and universities to make active changes in school running orientation, specialty setting, curriculum system, education and teaching methods and teaching contents according to the needs of transforming and upgrading traditional industries and cultivating and expanding emerging industries, so as to cultivate talents supporting industrial development, so as to drive the development of new economy and new industries. As the local undergraduate colleges and universities that train engineering talents account for more than 90% of the total number of ordinary colleges and universities in China, how local undergraduate colleges and universities grasp the construction of "new engineering" and explore their own development path is directly related to the effectiveness of the construction of new engineering in China.

After the emergence of "new engineering" in 2016, the Ministry of education carried out in-depth research and discussion, reached a consensus on "new engineering", formulated an action plan for "new engineering", and formed a "Beijing Guide", which means that the reform of talent training mode with the construction of "new Engineering" as the core has entered a new era. Advocating the new concept of "new engineering" is an important measure for the reform of national engineering education according to the new requirements of national strategic deployment, the new situation of trade competition and the new requirements of talent training. It is a new concept, new form and new strategy for building morality and cultivating people in colleges and universities. Under the background of multi polarization of political structure, globalization of trade, diversification of knowledge and digitization of the times, the industrial revolution and technological innovation centered on the Internet have emerged with the trend, the number of cross integrated disciplines has increased, characteristic specialties have been presented, and innovative skills have emerged one after another, promoting industrial transformation and upgrading. The transformation of old and new kinetic energy has been an innovative strategy for the international community to seek the bright spot of differentiation. As of June 30, 2020, there are 2740 ordinary colleges and universities (including 265 independent colleges). About 300 local undergraduate colleges and universities will gradually turn into Application-oriented Undergraduate Colleges and universities, accounting for 11%. The scale of the transition institutions is huge, and there are many restraining factors in the transition process, such as the bondage of thinking ideas, the conservatism of thinking, the lack of production education integration system, the defects of management system and the weakness of teaching team. Under the "new engineering" situation, local undergraduate colleges and universities, according to the talent training objectives and local economic construction, improve their school running potential and create innovative competitive advantages by efficiently organizing the reform of curriculum system, opening up the discipline context, school running orientation, specialty setting, curriculum system, education and teaching methods and teaching contents, This is the necessary starting point to explore the problem.

### 1 Meaning and characteristics of "new engineering"

The central meaning of "new engineering" is "Engineering", which tends to be "new". To accurately

understand the connotation of "new engineering", we must not leave the nature of "Engineering", and grasp its "new" characteristics. In other words, "new engineering" must understand its concept under the overall framework of engineering education, and then continue to expand in order to be viable. However, how to integrate new components or units into the engineering structure to make it more adapt to the discipline and professional progress rules and meet the needs of industrial progress is the core of problem research<sup>[1]</sup>.

China's one belt, one road, and Internet plus, and so on, are implementing the innovation driven strategy, implementing the "China made 2025", "one belt and one road" and "Internet plus" important policy decisions, and strive to promote dynamic adjustment of new industrial structure characterized by new forms, new standards, new brands and new forms, and promote the upgrading of economic structure and industry innovation. In the new era, technological innovation and economic reform promote the redistribution of social resources and the reconstruction of economic relations. The infiltration and integration of majors in colleges and universities are becoming closer and closer, and new majors are emerging. They give new historical missions to the reform and development of higher education, promote the continuous development of the research field of undergraduate colleges, and reflect the characteristics of the times such as scientific and technological progress, network reform and the renewal of pillar industries. Taking advantage of the situation and planning the route of "new engineering" in advance, we should not only deeply explore the logical meaning and progress process of higher education reform, but also establish the "new thinking" of higher education reform from the perspective of development, shape the "new structure" of local specialties of Higher Education, and explore the "new mode" of local talent training of higher education, so as to realize innovation in science and technology hub areas, Meet the upgrading and development needs of future ecological communities and help the establishment of new economic industries. Therefore, "new engineering" should not only grasp the market direction, but also highlight the strategic focus. From the perspective of the fourth industrial transformation, "made in China 2025" targets the "industrial Internet" of the United States and "industry 4.0" of Germany. Facing the reorganization and integration of international economic structure, it is intended to establish an irreplaceable industrial innovation system reflecting sustainable development. The new technology model redefines the meaning of "Engineering", replaces various disciplines to perform their respective duties by virtue of the reorganization of the brokerage industry chain, promotes the in-depth integration of digitization and industrialization, and embodies the characteristics of "reorganization and integration" and "wisdom and creativity". The Internet plus technology is rapidly entering the field of information construction. Digital innovation is to occur frequently, and the sustainable resource connection pool is created. It also indicates the transformation and upgrading of a series of processes, such as manufacturing, communication, consumption and operation, and leads higher education to move towards the goal of training across the traditional training mode and industry. Establish a "new engineering" industrial system with a new structure. In other words, integrating new meanings into today's engineering system to meet the needs of the development of emerging industries and information technology can be defined as "engineering +". According to the interpretation of information theory, "engineering +" is still a social system composed of the same engineering system. However, each link of this system does not exist independently. Organizations break through the constraints of space, integrate and upgrade, and form a mutually integrated organizational logic.

The orientation of new industry and new engineering is the process of constantly exploring the innovative talent training mode of undergraduate colleges on the premise of conforming to the logic of talent training. The rapid technological change and economic transformation in the world are driving the evolution and promotion of new industries and new projects. World trade is in an era of continuous adjustment. "New engineering" is not a narrow category and static term. Therefore, the requirements of educational strategy, economic form and scientific and technological reform on the quality of industrial talents are not static. From reaching the consensus of "new engineering", formulating the action plan of "new engineering" to forming the "Beijing Guide", it reflects the subjective narrow sense of social cognition. The historical mark of industrial upgrading restricts the process of "new engineering" in local undergraduate colleges and universities. In the initial stage, there is a vague understanding of the concept, characteristics, norms and definition of "new engineering", which needs to be continuously improved and updated. In the process of building a "new engineering discipline", it is necessary to implement the organization and scheduling that conforms to the development trend of the trend of talent training according to the trend of economic transformation and development<sup>[2]</sup>.

## **2 Restrictive factors of constructing "new engineering" in Local Undergraduate Colleges**

In the existing undergraduate education framework in China, the training objectives of discipline colleges and universities are relatively clear, but local undergraduate colleges and universities lack "social identity", suffer from "double rolling", and there are "different levels" and "convergence", especially the Newly-built Local Undergraduate Colleges and universities. With the transformation of China's economic form and the improvement of industry transformation, during the construction and implementation of "new engineering" in local undergraduate colleges, the contradictions hidden under the surface of some higher engineering education

systems are increasingly exposed, which are specifically reflected in:

#### 2.1 the thinking concept is bound, and the cognition of talent training is one-sided

The 2020 global competitiveness report issued by the world economic forum on June 19, 2020 points out that China ranks 20th and is one of the most powerful new industrial bodies in the world. Thinking is the basic point and condition of activities. The basic characteristics of school running orientation of engineering education are complexity, skill, creativity and efficiency. However, at present, there are cognitive errors in the school running objectives and talent training orientation of local undergraduate colleges. The implementation of the fuzzy idea of discipline training, engineering training or practical training restricts the transformation and strategic choice of engineering education to a certain extent, resulting in the "contradiction" between the training objectives and the requirements of economic transformation and upgrading, and the "separation" between the specialty setting and the regional economic form, The "stagnation" of the functionalism oriented talent training cognitive system and the practical education mode, the "cover" of the discipline oriented school running orientation on the engineering training mode, and the "Relaxation" of helping to guide the transformation and upgrading of local economy, especially in the fields of concept value, skill operation, improved thinking, social services and so on .

#### 2.2 relying on the development of social organizations restricts the adjustment of professional structure

The level of independent running of local undergraduate colleges and universities is low, the awareness of serving social and economic development is weak, the sense of responsibility to guide the transformation and upgrading of local industries is poor, they can not cope with the reform of market structure, can not meet the requirements of local economic development, lack the ability to adjust training planning and optimize professional structure mechanism, and are not good at judging the new trend of economic reform and industrial transformation The new requirements and new characteristics lead to the planning, transformation and transformation of professional settings lagging behind the transformation and upgrading of the industry, highlighting the low consistency between professional settings and industry settings, and the substantial differences in professional structure and training positioning, economic transformation and upgrading and social services<sup>[3]</sup>.

#### 2.3 the school management system is obstructed, forming a bottleneck for the integration of industry and education

In terms of internal management system, local undergraduate colleges and universities set up institutions according to the "school - Secondary College - subordinate departments" distinguished by disciplines and majors. The school pays more attention to performance investigation and internal affairs of subordinate secondary colleges, and the boundaries are strictly delimited. It is not easy to implement the coordinated adaptation of school running objectives and industrial development of colleges or majors, which restricts the cross-border integration of schools and enterprises to a certain extent. In terms of professional title evaluation and employment system, it focuses on the evaluation system based on academic papers<sup>[4]</sup>. Academic research can not meet the requirements of regional innovation and development, which is not conducive to leading local economic development and human resources exchange between local colleges and local industries. In the performance evaluation, the assessment indicators such as contribution to the local economy and innovation technology strength were not effectively implemented.

### 3 Reform ideas of "new engineering" talent training mode in Local Undergraduate Colleges

The report of the 19th National Congress of the Communist Party of China clearly pointed out the need to deepen the integration of industry and education and school enterprise cooperation, and deeply analyzed the integrity, complexity and cross-border nature of engineering education reform. According to the concept and basic characteristics of "new engineering" and the school running objectives of "new engineering", the talent training mode of "new engineering" in local colleges and universities must promote the innovation of discipline and specialty system, eliminate the disadvantages of management system, and establish freedom and harmony, adapt to development, in-depth integration, organic transformation Multi party cooperative engineering higher education environment.

#### 3.1 Digital fusion industry operation data acquisition program

The main feature of local undergraduate colleges and universities is "regional", focusing on regions and service regions to provide strong support for the transformation and upgrading of local industries. "Coming from the industry, pushing along the industry and developing with the industry" is a profound reflection of the talent training process of most local undergraduate colleges and universities. Educator fan Hayes put forward the school running orientation of "the purpose of talent training in Colleges and universities is to serve the local

economy" and "the border of colleges and universities is also the border of administrative regions", which is the best analysis of talent training in local colleges and universities. Collect data related to local industry development and thematic expansion data through higher education institutions, industry associations and social institutions. Analyze and sort out various collected data (such as industry implementation strategy and progress, supply of engineering talents, energy information data already available in the industry, etc.), master the rules of local market and industry transformation and upgrading, evaluate its progress trend, and comprehensively compare the reflected transformation rules with the adjustment of discipline planning and specialty setting of local colleges and universities, Using the function of introduction to mathematics, make relevance comparison, summarize characteristic concepts, construct program paradigm, explore the dynamic relationship between industry setting and specialty setting, analyze, summarize and discuss, so as to provide reference for the strategic development of local colleges and universities .

### 3.2 Update specialty setting based on local industry demand

Economic globalization and the rapid development of China's economic industry require the construction of new engineering disciplines to adapt to the changes in the talent market brought about by the changes in industrial demand, constantly transform and upgrade the existing disciplines, and adjust and improve the existing disciplines. Local Undergraduate Colleges and universities should recognize the special way of the construction of new engineering majors, change from simply "discipline based" to "market-oriented", strive to create majors that meet the needs of industry, and build a new structure of disciplines and majors combining emerging engineering and traditional engineering. Specifically, we need to start from the following aspects<sup>[5]</sup>.

First, master the demand of local economic development for new engineering talents. Local Undergraduate Colleges and universities should enhance their political awareness, responsibility awareness, service awareness and overall situation awareness, comprehensively grasp the advantages of external resources, carefully study local development planning and industrial development policies, analyze strategic emerging industries and new business forms and new models in regional economic and social development, strengthen the investigation of the demand of Industrial Development for engineering and scientific talents, and actively adjust the orientation of talent training objectives, Actively meet the needs of regional economic development for new engineering talents, and actively plan the construction of new engineering majors.

The second is to broaden the channels for the transformation and upgrading of traditional advantageous engineering majors. In order to promote the reform and innovation of existing engineering majors, local undergraduate colleges must, according to the needs of local economic and industrial development, integrate the existing majors with emerging technologies such as information communication, electronic control and software design through the penetration and adjustment of informatization, intelligence or other disciplines, so as to form a new engineering major. The era has entered the stage of intelligent manufacturing, which requires local undergraduate colleges to inject intelligent manufacturing elements into traditional engineering majors, make their talent training, R & D and innovation adapt to the development of China's industrial transformation and upgrading, and constantly provide technical support for the development of local industrial value chain to the middle and high-end<sup>[6]</sup>.

Third, pay attention to the cross integration of multi-disciplinary disciplines. Experts predict that most of the major categories facing new technologies in the future need cross integration in multiple fields. Therefore, local undergraduate colleges and universities need to update the division of existing engineering majors in time according to their own discipline advantages, expand the connotation construction of engineering majors, and form a system with traditional engineering majors as the support and emerging engineering majors as the guide by promoting the cross compounding of existing engineering majors and the cross integration or extension of engineering and other disciplines. 24 Cross engineering specialty is a collaborative development pattern.

### 3.3 Innovate the talent training mode with collaborative development as the consensus.

The construction of new engineering is a national strategic plan for higher engineering education. To implement the construction of new engineering courses, local undergraduate colleges must pay attention to their supporting role in local economic development and industrial transformation and upgrading. Therefore, local undergraduate colleges and universities should firmly establish the awareness of coordinated development of government, enterprises, learning, research and application, based on national conditions, provincial conditions and school conditions, adhere to complementary advantages, mutual benefit and win-win results, and innovate the new engineering talent training mode from multiple focus points<sup>[7]</sup>.

First, improve the multi-agent collaborative education mechanism and form an institutional mechanism for social participation in talent training. Therefore, local undergraduate colleges and universities should accurately grasp the external development advantages, comprehensively analyze the advantages and disadvantages of their own development, strive for the support of local governments, industry enterprises, social funds, other colleges and universities and other external resources, jointly explore and formulate the objectives and plans for the

training of new engineering talents, jointly build courses and develop tutorials through joint tackling of key problems by schools, enterprises and government. Jointly build laboratories and training practice bases, jointly train teachers and carry out research, build an engineering education responsibility community, focus on relying on regional industrial advantages, and promote the reform of the collaborative education system mechanism of the combination of science and education, the integration of production and learning, and school enterprise cooperation. In particular, local undergraduate colleges and universities should pay attention to adopting practical measures to establish multi-level and multi field school enterprise cooperation with domestic, foreign and local well-known enterprises, such as building a number of industrialized colleges and building a local shared talent training practice platform that can be jointly built and managed with industrial enterprises; Establish industry university research cooperation demonstration colleges, practice bases or engineering innovation training centers serving the development of new industries, new formats and new technologies in the region, and make every effort to gather external development advantages to run schools in the University.

Second, adjust and update the professional content to promote the training of new engineering talents to keep pace with the times. Local Undergraduate Colleges and universities should introduce the latest development of industry and technology and the latest requirements of the industry for talent training into the teaching process, update the teaching content and curriculum system, and build curriculum and textbook resources to meet the needs of industry development. Schools should support teachers to introduce the new progress of subject research to students, and encourage teachers to translate the research results into teaching content in time. The school can establish an enterprise club in the school to attract members of well-known enterprises at home and abroad and local governments. Some courses of the school can be taught by the tutors of member enterprises, and some courses may not have designated teaching materials. The tutors can adjust the teaching scheme in combination with the actual engineering problems and enterprise needs, so that the imparted knowledge can be applied. In addition, local undergraduate colleges and universities should cultivate engineering talents through scientific and feasible curriculum, and a knowledge system of interdisciplinary integration. This can be done in two ways: one is to set up interdisciplinary courses, establish interdisciplinary teaching teams, build an interdisciplinary project platform, promote interdisciplinary cooperative learning of new engineering talents and master interdisciplinary teaching knowledge; Second, according to the development of society, we should constantly open classic humanities and social sciences courses to enrich the humanistic knowledge of new engineering talents, expand their horizons, and inspire their critical thinking, innovative thinking and engineering thinking, so as to improve their comprehensive ability to solve problems<sup>[8]</sup>.

#### 3.4 take the guarantee system as the starting point to improve the quality of talent training

The development of new economy poses new challenges to the training quality of engineering professionals, which requires local undergraduate colleges to establish an all-round, scientific and effective teaching quality assurance system.

First, clarify the quality standards of engineering education. The premise of cultivating new engineering talents is to clarify the quality standard of talent training. Therefore, local undergraduate colleges and universities should constantly develop quality standards for emerging engineering majors in accordance with the requirements of new engineering construction, and formulate and optimize the training plan for new engineering talents in combination with the school situation and the established professional quality standards. Local Undergraduate Colleges and universities should deeply understand the importance of the professional certification system of engineering education, take professional certification as an important starting point and basic work of discipline construction, gradually implement the professional certification system of Engineering Education in teaching, and formulate talent quality standards in line with the school's own development and national and regional economic development, Continuously improve the training quality of engineering talents in local undergraduate colleges and universities.

The second is to explore the teacher guarantee mechanism of two-way communication in engineering education. Training new engineering talents requires a group of high-level professional teachers with strong engineering practice ability. This requires local undergraduate colleges and universities to actively explore the two-way communication mechanism between college teachers and industry talents, establish a personnel assessment and employment system and internal incentive mechanism in line with the characteristics of engineering education, formulate teacher evaluation standards and teacher development mechanism in line with the characteristics of engineering education, explore the construction path of Teachers matching the new engineering subjects, and strengthen the engineering background of teachers, Put forward clear requirements for teachers' industrial experience and actively create conditions<sup>[9]</sup>.

The third is to form an organizational guarantee for the opening and integration of engineering education. Local Undergraduate Colleges and universities should break through the bottleneck of system and mechanism and provide organizational guarantee for the cultivation of new engineering talents with multi-disciplinary integration by building an internal collaborative education organization model, such as new institutions with



interdisciplinary integration and industrialized colleges. Local Undergraduate Colleges and universities should establish internal and external alliance institutions that gather advantageous resources of industries, enterprises and scientific research institutes, jointly formulate training objectives and training plans for new engineering talents, jointly build and develop courses, jointly build experimental and training bases, cooperate to train teachers and carry out research, so as to form an organizational guarantee for collaborative education. In addition, local undergraduate colleges and universities should also look at the world, learn from international advanced ideas, based on the forefront of engineering education reform and development, and clarify the focus and direction of engineering education development.

As an in-depth reform of higher engineering education from the perspective of national strategy, the construction of new engineering courses echoes the development of the times. Local Undergraduate Colleges and universities should take the construction of new engineering as the "conscious action" and "independent behavior" of their own development, actively cater to the reform and development of higher engineering education, and constantly cultivate engineering and technical talents suitable for local economic development.

#### 4 Conclusion

"New engineering" is put forward by colleges and universities following the trend of social industrial transformation and upgrading, continuous adjustment of new and old kinetic energy and transformation of industrial structure. It is a reflection on the training mode of engineering talents in the development stage of high-tech industry. In the connotation construction of "new engineering", local undergraduate colleges should take the requirements of economic development as the starting point, take the new mode of talent training as the positioning, take the adjustment and upgrading of engineering education as the means, actively adapt to new challenges, and establish school running positioning, specialty setting, cooperation system, management mechanism and talent training system. The construction of "new engineering" talent training mode requires the full cooperation and continuous exploration between colleges and universities and government agencies, education departments and industry enterprises.

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