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Exploration of the Major Upgrading and Talent Training Mode in Local Universities under the Background of New Engineering

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Abstract: *In order to respond to the needs of the development of the new era, the country has put forward the strategy of new engineering construction. Local universities must actively respond to the strategy of new engineering construction in engineering education. Through constructing new engineering majors, upgrading existing majors and exploring talent cultivation mode, so as to form a new engineering talent cultivation program with its own characteristics. This paper discusses the ideas of construction of new engineering majors in local colleges and universities from the incompatibility and outstanding problems faced by the current status quo of engineering majors education in local colleges and universities with the requirements of new engineering construction.*

Keywords: *New engineering, Local universities, Major upgrading, Talent training mode*

1. Introduction

Early studies mainly proposed the connotation of new engineering from the starting point of what is new engineering, why and how to build new engineering, and also overlooked engineering education from the cultural height of new engineering, and regarded cultural elements as the key to new engineering [1], which greatly enriched the connotation of new engineering. In the aspect of innovation of engineering education, it is proposed that the new engineering science is broad, forward-looking, cross-cutting, open and practical, as well as the problems to be solved by innovation of engineering education. In terms of construction, it is proposed that the construction should be based on meeting the needs of the society and independent development based on classification. In the construction, it should face the problems of insufficient conceptual understanding, fragmented construction, and lack of in-depth cooperation between industry and academia and put forward the future direction of the new engineering construction [2]. The main bottlenecks of new engineering construction are analyzed, the basic path of new engineering construction is proposed, and ideas and experiences are given on how to promote new engineering construction in different types of universities. In terms of concrete actions, it is proposed that the CDIO model should be introduced into the construction of new engineering to realize the change from concept to action [3]. From the perspective of quality management, it is pointed out that the construction of new engineering majors is essentially a concrete manifestation of the dynamics of the requirements of education stakeholders, and a model for analyzing the process elements and empirical analysis of the quality of the construction of new engineering majors is presented [4]. From the level of cultivation, a "two-line" interdisciplinary cultivation program and an innovative curriculum system with the integration and interaction of "theory" and "practice" are designed [5]. The main tasks and core tasks in the reform of curriculum system and curriculum construction of new engineering majors are analyzed and studied, and the value orientation and components of new engineering curriculum system are proposed [6]. In terms of cultivation mode, a new idea of practical teaching in the context of new engineering, "ternary cooperative education mechanism" and the allocation of educational and teaching resources were proposed, and new ideas on practical teaching were put forward [7].

2. Major issues in local universities

2.1. Mismatch between the positioning and value orientation of local universities

There is a phenomenon that local colleges and universities blindly look to national-level colleges and universities in terms of school positioning, formulation of professional training programs and selection

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of training modes. This has weakened the unique functions given by local colleges and universities in the higher education system and led to the convergence and loss of position, making the students cultivated have a large gap with industrial demands and weaker competitiveness. The current construction of new engineering emphasizes on the development of classification, promotes colleges and universities to run characteristics and levels in different levels and fields, and play their respective roles in industries, and especially requires local colleges and universities to play a supporting role in regional economic development and industrial transformation and upgrading. The process of new engineering construction is a process for local colleges and universities to correct their deviations and return to their values.

2.2. Mismatch between major education and the demand of new engineering talents

The problem of scientificization of engineering professional education is common in all universities, and the scientific-oriented educational concept and training mode have been deeply cured. The problem space definition of majors is large and comprehensive, and lacks relevance;. The overall design of engineering education in the cultivation program is lacking, and the engineering-oriented concept is not fully reflected. In the process of curriculum teaching, there is a lack of engineering-oriented teaching design and practice. As a result, students' engineering thinking ability and engineering literacy have not been systematically cultivated.

2.3. Mismatch between sustainable improvement and the existing professional quality assurance system

Result-oriented professional education quality management approach is a guarantee for high-quality training of talents in the context of rapid technological and industrial changes. However, the current lack of a guarantee mechanism for feedback and improvement of professional quality evaluation in professional education has led to result-oriented and continuous improvement becoming an empty phrase. The reasons for this can be attributed to three main aspects: (1) improvement mechanisms need to be supported by systems and norms of professional education assurance. (2) Regular assessment and evaluation should be the basis for professional improvement and become a consciousness. (3) Effective quality control, feedback mechanisms and environmental support are needed.

3. Issues in talent training model

3.1. Talent training system is not compatible with industrial development

The disciplinary scope and boundary of future professional education have new connotations compared with traditional engineering majors, and crossover, integration, penetration and expansion will become the disciplinary characteristics of the new engineering majors. The current professional education and personnel training are not in the same direction or at the same pace as the major development strategies of industries, less sensitive to the development of industries and major changes, and not open, integrated and supportive enough for industries. The depth, breadth and effectiveness of the combination of industry-university and industry-education are not enough. The main manifestations are: (1) the knowledge system lags behind the market and industrial development needs, and lacks the leading edge technology. (2)Lack of mechanisms and platforms for effective integration of multiple disciplines. (3)The training program lacks flexible and adaptive adjustment and improvement mechanisms. (4)Lack of collaboration motivation and institutional guarantee for multi-party collaborative and cooperative cultivation, which leads to an unsound and irregular collaborative mechanism and makes it difficult to establish a systematic and substantial collaborative cultivation system, mostly staying at the level of collaboration in a certain course or a certain link, and the effectiveness of cultivation is low.

3.2. The engineering level of teachers is not compatible with engineering education

The teachers' awareness of engineering is not strong and their engineering ability is not sufficient, and there is a big gap with the requirement of engineering ability for teachers in the new engineering discipline. Firstly, in terms of education concept, the overall design of teaching and implementation of teaching process, engineering-oriented ideas have not been fully established and integrated into it; secondly, the policy guidance and evaluation system of the university do not promote teachers to go

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deeper into the industry; thirdly, teachers lack understanding of the development and changes of the industry, and the industry-academia integration and industry-teaching integration are superficial. At the same time, faculty members' intellectual innovation is constrained. The knowledge innovation ability of teachers in colleges and universities is manifested by their discoveries, inventions or creations in the field of their disciplines and specialties. Some university teachers, especially those in private universities, lack scientific research platforms, policy support and financial support, so their scientific research work is stagnant and their professional knowledge cannot keep up with the times. There are a large number of retired teachers in private colleges and universities, who hardly participate in scientific research and have zero knowledge innovation achievements. In addition, some teachers work behind closed doors, lack the sense of teamwork, and do not pay attention to cross-discipline, industry-university integration and international cooperation, so it is difficult to find a breakthrough in knowledge innovation and lack inspiration for knowledge innovation.

4. Major upgrade exploration

4.1. Establish a multidimensional talent demand dynamic model

In view of the problems that the orientation of engineering majors in local universities does not match with their proper value orientation, the space for professional problems is large but not real, and the teaching contents are comprehensive but not strong, a multi-dimensional (new technology, regional application, product value chain) talent demand dynamic model is established, and new technology, regional industrial application, and engineering problem solving in regional industrial upgrading are considered as the talent demand elements, and this is used as the constraint, while emphasizing new technology and regional application, the product value chain dimension matching with CDIO concept is used to highlight the engineering characteristics of talents. In addition, we use the product value chain dimension that matches the CDIO concept to highlight the engineering characteristics of talents, so as to solve the problems of not highlighting the characteristics of serving the region, large but not real professional problem space, and comprehensive but not strong teaching contents.

4.2. Quality assurance standards based on engineering certification

In view of the incompatibility between the sustainable improvement of majors and the existing quality assurance system, we establish engineering accreditation-oriented quality assurance standards to realize regular diagnosis, evaluation, feedback and guidance of majors, and use them to regulate the management of majors, promote the construction of majors, support the continuous improvement of majors, and finally achieve quality assurance and improvement of majors' education.

4.3. Selected major design topics

The classical algorithms and problems in the course of algorithm analysis and design are the core of the course, and the content of the course design is selected, combined with mobile Internet, cloud computing, big data, positioning and navigation, software development, etc. The number of selected projects is strictly controlled to ensure competition and exchange and cooperation between groups. Let teachers become mentors, and let textbooks become literature and reference books to improve students' ability to adapt to changes and engineering innovation. For example, we set topics based on Voronoi diagram construction and new engineering content: Voronoi diagram-based nearest neighbor optimization clustering algorithm, Voronoi diagram-based 3D printing lightweight structure design, Voronoi diagram and game strategy-based multi-drone trajectory planning, etc. In addition, we have also developed a number of topics related to cloud computing and Internet technology, such as solving the minimum cut privacy protection problem for undirected weighted graphs, designing quantum computing algorithms for solving the TSP problem, and protecting the privacy of big data under the Internet of Things.

5. Talent cultivation model exploration

5.1. Flexible training program

The training program is guided by the application and development of new technologies in regional industries, and the knowledge is reconstructed. At the same time, through the commonality of

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technologies and the characteristics of applications, the training program is embedded in a flexible adjustment mechanism to support the formation of flexible training programs. We will build and implement a multi-layered collaboration platform, with a focus on internal school-enterprise collaboration. In addition, through the continuous improvement mechanism in the guarantee standard, we can further strengthen the matching between talent cultivation and demand, and solve the structural contradiction between talent cultivation and demand.

5.2. Application engineering of training programs

Infusing application-driven and engineering-led ideas into the cultivation program. Firstly, the application engineering problem-solving ability is taken as the cultivation goal. At the same time, we refer to the CDIO framework, rebuild the professional problem space, reshape the professional boundary, and reconstruct the cultivation program, so as to fundamentally establish the infrastructure and route of engineering talents cultivation and form a new ecology of engineering talents cultivation with multidisciplinary integration.

5.3. Conduct blended teaching mode

The student-centered BOPPPS and complex teaching methods are widely used in the classroom. Students are instructed to watch online teaching videos, combine MOOC and SPOC, and consult Chinese and English literature and various technical materials before the class, in order to master the classical algorithms, popular algorithms, and applications of the problem under study in both breadth and depth. The English language study is applied to the major study as a learning tool for the algorithm design and analysis course. The instructor teaches the basics and gives basic algorithm design strategies, and students discuss and communicate the readings, exercises, and programs, while the instructor provides guidance and evaluation.

6. Conclusion

This paper explores the talent cultivation mode by means of flexible cultivation program and engineering application of cultivation program, starting from the problems of upgrading majors and talent cultivation program in local universities. At the same time, it provides new methods and new ideas for the construction of new engineering disciplines in local universities by establishing a multi-dimensional talent demand dynamic model and establishing a quality assurance standard based on engineering certification for the upgrading of majors.

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