Discussion on the Construction of the Core Curriculum of General Education in Engineering Majors in Colleges and Universities under the New Background

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Abstract: In the paper, the core curriculum construction of general education in engineering majors in the new era are explored under the background of emerging engineering, the national work conference of undergraduate education for higher colleges and universities, and the launch conference of six excellence and top-notch program 2.0 and so on. In view of the new challenges faced by the core curriculum of engineering general education under the new situation, a series of reform measures are explored, including updating the concept of curriculum construction, doing a good job of top-level design, fully utilizing existing resources and adopting the curriculum construction program of multi-mode combination of high-level forums and academic reports, quality offline core course and quality network core courses, all of which have improved the quality of the core curriculum construction of general education in engineering majors.

1. Introduction

At present, the state is implementing innovation-driven development and major strategies such as One Belt and One Road, Made in China 2025 and Internet Plus. The new economy represented by new technologies, new formats, new models and new industries is booming, and which puts forward higher requirements for engineering science and technology talents. The emerging engineering came into being under the background. It has become the consensus of the whole society to cultivate talents who are in urgent need in the new economy and lead the future development of technology and industry. General education is a complex systematic education project, is a kind of value education that integrates social consensus, and which is intended to guide students to explore a wide range of disciplines, further broaden their knowledge, strengthen the integration of humanities and scientific qualities, overcome the one-sidedness and limitations brought about by specialization, and cultivate a complete person with sound personality, comprehensive and harmonious development [1][2]. Fudan University Consensus [3], Tianjin University Movement [4] and Beijing Guidance [5] are the trilogy of emerging engineering construction, which put forward new requirements for talent training under the new situation from different angles, and the new requirements related to general education have been motioned many times. The initiative of regarding undergraduate education as the foundation and four regressions [6] were put forward on the national work conference of undergraduate education for higher colleges and universities which was held by the Ministry of Education in June 2018. In April 2019, at the launching ceremony of the six excellence and top-notch program 2.0, Minister Chen Baosheng emphasized that it is necessary to build on the new era and strengthen the sense of responsibility, break school boundaries, subject boundaries, professional boundaries and classroom boundaries, and promote the cross-integration of disciplines and professional, and promote the cultivation of compound talents.

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Now, Chinese higher education is in a critical period of connotation development and quality improvement and in a key stage to strengthening the talent cultivation ability and building a strong country in higher education. Since entering the new era, the development of higher education has made historic achievements, but there are inevitably some problems. The engineering majors in higher colleges and universities, which train high-tech talents for the future, should focus on the emerging engineering and new requirements of engineering, train a large number of high-quality professionals with ideals, skills and responsibilities, so as to enhance the country's hard power. The core curriculum construction of general education, as an important part of the engineering professional, should be emphasized and strengthened.

2. New Challenges in the Construction of the Core Curriculum of General Education in Engineering Majors under the New Situation

Since the 1990s, the general education of Chinese colleges and universities has once again ushered in the spring of development. Under the leadership of the Ministry of Education, many Chinese colleges and universities have begun a series of educational reforms and explorations [7], and achieve a lot of achievements. However, the core curriculum construction of general education in many engineering majors in colleges and universities cannot fully meet the needs of the talent capacity system to be cultivated in emerging engineering construction against the new requirements of new era, and there are some new challenges.

2.1 Lack of sufficient awareness and attention

The survey results show that there are still a certain number of teachers and managers who still understand the general education curriculum using the thinking and regularity of professional courses and rarely consider the reform and innovation of general education. At same time, for the general education curriculum, there are still a certain number of students who only care about what the training program requires and what they should choose. They do not care why such training programs are designed, nor what external benefits these courses will bring to them except credits.

2.2 Lack of a comprehensive core curriculum system of general education for students to choose freely

At present, for the core curriculum of general education, many engineering colleges and universities focus on the curriculum construction across liberal arts and science or across liberal arts and engineering, and pay little attention to the construction of the core curriculum of general education across multiple engineering majors in the engineering science category. The number of these courses is small, and the curriculum system is not perfect enough, so that students do not have sufficient choices. At the same time, due to various reasons, some of the offline core courses of general education are greatly influenced by professional courses, the concept of general education is not prominent enough, the organization of teaching content is not systematic, the management of teaching process is not standardized, and the quality of curriculum construction needs to be improved.

3. Updating the Concept of Curriculum Construction and Doing a Good Job of Top-level Design

The emerging engineering construction has clear provisions on the goal of personnel training. It will strive to build multi-dimensional knowledge and capability structure and regard providing high-quality talents reserves for technological innovation, scientific and technological inventions and acquisition of independent intellectual property rights as the talent training specifications. Under the new situation, the general courses of engineering majors should be examined from the higher perspectives of the requirements of future citizen information literacy, the sustainable competitiveness of students after they enter society, and the resulting national development strength [8]. Students should be the center, the general education and professional education should be

closely coordinated, and it should be the goal to strive to improve students' core competences.

It is necessary to closely contact the current emerging engineering construction, gain an insight into the important issues in the current and future period in our country, base on the current reality and focus on the future development in order to do a good job in the overall design and long-term planning of general education from the top, and use this as a program of action to guide the construction of the core curriculum of general education. For engineering colleges covering a number of first-level disciplines under the engineering category, the core curriculum of general education should include not only the content beyond the natural science and engineering technology modules with large disciplines, but also the engineering general courses of the non-first-level disciplines of these two modules, and all of which must have both the concept of science and technology, the theory of science and technology, and the theory of thinking and methodology. The teaching contents of engineering general education should not only come from methodology, but also from multiple ways of thinking, such as computational thinking [8], engineering thinking, control thinking and many other ways of thinking. In student's training program, not only should there be courses applicable to a certain engineering-level subject, but also courses suitable for some first-level subjects. Under the background of emerging engineering, the construction of core curriculum of general education in engineering majors is not only the construction of multiple independent courses, but also a systematic project, which needs to do a good job of top-level design from the perspective of development and from the height of strategy, to develop a practical system of general education and training programs, and to ensure the system.

4. Combining Multiple Modes to Improve the Construction of the Core Curriculum System of Engineering Knowledge Education

Under the new situation, it is an inevitable trend to cultivate students' ability of cross-border integration, that is, to carry out professional education on the basis of general education. Therefore, the core curriculum of general education in engineering majors should strive to oscillate through the hot surface of electronic technology, communication technology, computer technology, control technology, machinery manufacturing and its application, and should not sway with the wind direction of these technologies. Teachers should refine the ideas and methods behind them, and give students the opportunity to fish instead of giving them fish. It is impossible for a teacher to envisage in advance what problems a student encounters after graduation. He can only teach the common characteristics of the problem and the basic ideas and methods of the problem, so that when the problem is really encountered, the learned knowledge can be used comprehensively to solve it. The engineering colleges and universities should fully tap and utilize existing resources and adopt a combination of high-level forums and academic reports, quality offline core courses and quality network core courses to strengthen the core curriculum construction of innovation, entrepreneurship, engineering and technology, and so on. They should adhere to independent construction combining with the introduction, strengthen the sense of quality, give full play to the advantages of comprehensive discipline, introduce the competition mechanism, attract famous teachers and famous artists into the classroom, ensure the thickness and solidity of the foundation of general education, and further improve the core curriculum of engineering general education suitable for the construction requirements of emerging engineering, so as to give students electives and consolidate their general education foundation.

4.1 Incorporating high-level forums and academic reports into the core curriculum system of engineering general education

The speakers of the high-level forums are generally well-known scholars, great master and some well-known international experts at home and abroad. The forms not only can further promote the excellent school spirit of seeking truth and seeking innovation, inherit the excellent academic spirit of Chinese culture and build a high-level academic, so as to let teachers and students listen to the voice of the wise and feel the power of thought and create a strong academic atmosphere of competition, but also can expand students' international horizons, activate their thinking ability,

activate the academic atmosphere, create a good campus culture atmosphere, and enhance the overall quality of students. High-level forums and academic reports help to prosper campus culture, broaden academic horizons, promote quality education, and cultivate students' innovative spirit and practical ability. Therefore, these resources should be fully utilized as part of the core curriculum system of engineering general education, set certain credits or honorary credits, and listed as compulsory courses for students.

4.2 Actively promoting the construction of the quality core courses of offline general education

At present, we should take the emerging engineering construction as an opportunity to establish a new concept of engineering education and personnel training, guide by the updated concept of general education and train complex engineering and technology innovation talents from all-round and multi-dimensional, who not only have international vision and high sense of social responsibility, as well as sound personality, innovative thinking and innovative ability, but also have the abilities of combination of liberal arts and science and life-long learning. All engineering colleges should carry out certain policy inclinations, encourage teachers, especially engineering professional teachers, to actively consider what kind of teaching contents are needed by students at present and in the future based on the requirements of emerging engineering construction for students' core competence. Guided by the problem, on the one hand, they should reform the existing core courses, on the other hand, they should actively develop the core courses of general education across first-level disciplines, and constantly break down the barriers of previous disciplines in order to build a broader general education system. Teaching entities should pay more attention to cultivating people who are fully developed, and teach students to learn to recognize, learn to do things, learn to coexist and learn to survive, so that students can not only understand the historical laws of related disciplines and science and technology, master the scientific world view, methodology, but also let students think systematically, and strengthen their sense of family and mission to take responsibility.

4.3 Orderly introducing the quality network core courses of general education

The introduction of the quality network core courses of general education, on the one hand, can enable students to have more choices in teaching program, have the opportunity to appreciate the style of well-known professors in various universities in China, listen to and accept the teachings and edification of teachers of different styles, so as to fully mobilize students’ enthusiasm of independent learning and effectively improve their own scientific and cultural literacy. On the other hand, it is also conducive to promoting the improvement of the quality of offline course construction. In this regard, we should adhere to the quality-oriented principle, do a good job of the overall layout, introduce them in an orderly manner, and form a pattern of complementing and competing with each other online and offline in order to enrich school's core curriculum system of general education and improve the quality of the core curriculum of general education.

In addition, it is necessary to specify that the construction of the core curriculum of engineering general education should be guided by the Double Ten Thousand Plan of the first-class curriculum (i.e. The Golden Courses Construction Plan) put forward by Higher Education Division of Ministry of Education in 2019. Whether offline or online core courses should be resolutely eliminated water courses and strive to create golden courses [9]. It is necessary to strictly control the classroom teaching, strengthen the examination management, strictly control the graduation exit, and implement the requirements of improving the quality of personnel training throughout the entire process of teaching management.

5. Conclusion

The construction of emerging engineering is a major measure to implement a series of major national strategic deployments, realize industrial transformation and upgrading, and transform old and new kinetic energy, as well as enhance national competitiveness and hard power. The aim is to

realize the Chinese dream of building a strong higher education country and the great rejuvenation of the Chinese nation by training a large number of high-quality composite engineering and technological innovation talents. As far as the general education of engineering majors in colleges and universities is concerned, the relevant teaching entities should closely combine the relevant requirements of the construction of emerging engineering, the national work conference of undergraduate education for higher colleges and universities, and so on, and deepen the understanding of the core competence requirements of emerging engineering construction, improve the top-level design and planning of the core curriculum system of engineering general education, and enrich the core curriculum system in multiple modes, such as incorporating high-level forums and academic reports, strengthening the construction of quality offline core courses and introducing quality network core courses, so as to continuously improve the quality of curriculum construction. The great cause is to be achieved, talent is the priority. Therefore, we should actively invest in such an important education reform with a high sense of responsibility and mission, and further improve the quality of the core curriculum construction of engineering general education.

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