

Cultivating Humanistic Qualities of University Students Based on the Background of China's New Engineering Disciplines

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Abstract: In order to meet the new challenges brought by the new round of scientific and technological revolution and industrial changes in the world, therefore, in the recent years the China's Ministry of Education has actively promoted the construction of "New Engineering Discipline." The cultivation of the humanities is important for the formation of core literacy of New Engineering talents, which may help to strengthen the intellectual foundation of New Engineering talents, further enhance their innovative ability. At present, the humanities education for higher engineering talents is still weak, therefore, it is important to build a complete humanities cultivation system, and further explore a new mode of humanities education for the future.

Keywords: New engineering disciplines; Humanistic qualities; Talent cultivation; New engineering

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1. Introduction

The new round of scientific and technological revolution and industrial changes worldwide, further the booming new economy sweeping the world have suggested a new requirement for the reform and development of engineering education. In recent years, China's Ministry of Education has been actively promoting the construction of the New Engineering disciplines, proactively responding to the new round of scientific and technological revolution and industrial changes, additionally, supporting and serving the innovation-driven development strategy. On the February 18, 2017, the Chinese Ministry of Education held a seminar regarding the development strategy of higher engineering education at Fudan University to discuss the cultivation of engineering talents in the new era, explore the connotation characteristics and development strategies of the New Engineering disciplines, and finally they reached a general consensus from the seminar, namely the "Fudan Consensus". The Fudan Consensus has proposed the reform and development of engineering education in China as a new historical meaning, meanwhile the engineering education is facing an important task of cultivating qualified engineering and technology talents for the future^[1]. Following the Fudan Consensus, the Ministry of Education has actively promoted the construction of New Engineering disciplines and released two important notices namely "Notice on Research and Practice of New Engineering" and "Notice on Promoting Research and Practice Projects of New Engineering," in order to explore the Chinese model, further experience in the global engineering education reform, and help the construction of higher education in the strong countries. The future of high-quality talents should not confine into rich engineering knowledge and the ability to solve engineering problems,

but also should have a broad global vision, humanistic spirit and innovation ability.

At present, the domestic and foreign researchers, especially, the domestic researches on the construction of New Engineering mainly focus on the following aspects; (1) Explaining the background, development process, and the importance of the New Engineering, where the representative result is accelerating the development and construction of New Engineering to actively adapt to and lead to the development of the new economy published by Wu Aihua and others, which further discusses the cultivation requirements of New Engineering talents from the aspects of facing the future, innovation and entrepreneurship of new talents, diversified cultivation mode, and lastly learning from international experience ^[2]; (2) Analyzed the connotation and framework of New Engineering, with the representative result of New Engineering and New Paradigm description of the concept, framework and implementation path published by Gu Peihua, which further proposed that the New Engineering should be a unity of New Concept, New Model, New Method, New Content, and New Quality ^[3]; (3) The talent cultivation mode of New Engineering has been explored, for example, the article Reform and Exploration of New Engineering Talent Cultivation Mode Based on Demand Orientation published by Liu Jie takes demand as the reform direction of talent cultivation mode, further discusses the inevitability and importance of reforming the talent cultivation mode of New Engineering, focusing on the reconstruction of the curriculum system and conduct school-enterprise cooperation to educate people ^[4].

The article title ‘Research on the Cultivation Model of New Engineering Talents’ published by Chang Longjiao focuses on the importance of cultivating innovative talents in the construction of New Engineering disciplines, further proposed few suggestions on the cultivation of innovative talents. In additional, an article title ‘An Analysis of Cultivation Model of Excellent Talents Adapting to Students’ Personalized Development and its Prospects in the Background of New Engineering’ published by Li Jinmao, further emphasized the reform strategy of people-oriented, student-centered, additionally adapting the students’ personalized development, advocating the setting of personalized talent cultivation goals, the setting of rich cultivation contents and the adoption of flexible assessment mechanisms ^[5].

Currently, overseas researchers are focusing on three mainstream concepts around engineering education reform, namely; (1) Competency-based Education (CBE). This model was proposed by Mc Clelland in the United States, who believed that the core competencies are the key elements for students’ successful employment and sustainable development; (2) Outcome-Based Education (OBE). This model is the educational model which is currently adopted by all engineering education in the United States, additionally, only undergraduate engineering degrees adopting the OBE model is recognized by the Washington Agreement ^[6]; (3) Conceptual-Design-Implement-Operate Education (CDIO). This model stands for Conceive, Design, Implement, and Operate. It takes the whole life cycle from product development to product operation, maintenance, and disposal as a carrier, and establishes an integrated, mutually supportive, and organically linked curriculum system, allowing the students to receive engineering education in an active and practical manner ^[7].

In short, after the idea of New Engineering is proposed, a lot of researches have been conducted in the academic circles on the meaning, connotation, and framework of the construction of New Engineering and talent cultivation mode, additionally, certain achievements have been made, however, the contents of the research are mostly macro and broad, and there is a lack of in-depth researches on the specific contents, especially the research on the relationship between the construction of New Engineering and the cultivation of humanistic quality is still weak. This paper will focus on the construction of core literacy in the construction of New Engineering, further analyze the significance of cultivating humanistic quality in the college students on the formation of core literacy of talents in New Engineering, and lastly explore the practical path of cultivating humanistic quality in the college students.

2. The definition of New Engineering Disciplines

In a 2015 study, UNESCO pointed out that globally, the higher education is undergoing revolutionary changes and has shown the trend of popularization, diversification, internationalization, lifelong learning, and informatization. It has transformed from the technical paradigm, which focuses on the application of technology, to the scientific paradigm, which focuses on scientific research, followed by the engineering paradigm, which focuses on practice, and always aiming to the new paradigm of the future. The first proposal of New Engineering Disciplines provides a new perspective and a Chinese solution for the reform exploration of higher engineering education [8].

2.1. Background of the New Engineering Disciplines

The New Engineering Disciplines are a major strategic of choice for the reform of engineering education in the context of the new scientific and technological revolution, the new industrial revolution and the new economy, and it is also a new way of thinking and development for the future reform of engineering education in China.

2.1.1. The construction of New Engineering Disciplines as an important guarantee for China to establish international industrial competitive advantages

Fundamentally, the basis of international competition is the competition on the talents and education. At present, the global issues such as, environmental pollution, energy tensions, local unrest, and ageing populations poses a serious challenge to sustainable human development, therefore, the international competition is becoming fierce, the economic globalization and anti-globalization coexist, additionally, the trade protectionism is on the rise. In addition, a new round of scientific and technological revolution and the industrial revolution is ready to be implemented, therefore, the cross-fertilization of disciplines is accelerating, thereby the disruptive technologies are emerging, giving rise to major industry changes and the development of new industries, and innovation-driven has become the core strategy for many countries to seek competitive advantages. Only by accelerating the reform of engineering education and cultivating innovative engineering talents, one should take the initiative to take up the responsibility of the times to cope with challenges, subsequently shape the future. Therefore, the construction of New Engineering education is an important guarantee to seize the opportunity and win the initiative in the fierce international competition in the future as never seen before.

2.1.2. The construction of New Engineering Disciplines is an important way to cultivate excellent engineering and science talents of composite type

At present, China's higher engineering education has made great initial achievements through an important initiative as the Quality Project, Excellent Engineer Education and Cultivation Plan and 2011 Plan. Currently, through these initiatives China's higher engineering education has made great achievements and formed an engineering education system with complete levels and specialties. However, there are still many problems in the practice of talent cultivation, for example, the cultivation concept is not suitable for the future changes, the implementation of the student-centered, and result-oriented engineering education concept is not established, the concept of lifelong learning and personalized learning is not fully integrated into the education process, the concept of interdisciplinary integration needs to be strengthened, and the concept of green engineering education has not been firmly established. Therefore, higher education must enhance the reform, face multiple challenges with a new attitude of New Engineering, cultivate complex and excellent engineering and science talents, additionally provide strong talent support for the economic transformation and social development [9].

2.2. Connotation and characteristics of New Engineering Disciplines

The division of disciplines is artificial. However, the development of new economies and new technological changes will not be solidified within a particular discipline because of the human definition of the discipline, the original disciplinary boundaries and industrial divisions are bound to be broken.

2.2.1. Connotation of New Engineering Disciplines

The term 'new' in New Engineering Disciplines contains three meanings, namely; Emerging: Refers to the new and unprecedented disciplines, focusing on the disciplines that are nurtured, extended and expanded from other non-engineering disciplines, such as applied science and other basic disciplines, which are oriented to the development of new technologies and new industries in the future; New type: Refers to the transformation, mainly transformation and upgrading of traditional disciplines, including the expansion of connotation, transformation or improvement of training objectives and standards, reform and innovation of training mode, and the formation of new disciplines; New born: Refers to the new disciplines generated by the cross-combination and cross-fusion of different disciplines. Firstly, the cross-compounding of different engineering disciplines can be achieved through the integration of more than two engineering disciplines. Secondly, the cross-fertilization of engineering and other disciplines. This cross-fertilization represents the new direction of modern industrial development and gives engineering talents new quality requirements [10].

2.2.2. Characteristics of New Engineering Disciplines

The New Engineering discipline has emerged in response to the development needs of new technology and new economy, and is generally characterized by leadership, innovation, integration and cross-border. (1): The construction of New Engineering will play a leading and exemplary role in the construction of other disciplines and specialties within the universities; (2): Outside the universities, the construction of New Engineering will promote the breeding and the generation of new technologies, thereby lead to the gradual formation of new industries through the industrialization of new technologies, where innovativeness is the essential requirement for New Engineering by the national economic and social development. Further the construction of New Engineering is to serve Innovation is the essential requirement of national economic and social development, and is to serve the new economic development characterized by new technologies and new industries, and innovation of talent cultivation mode will be the main task of the construction of New Engineering. It is a characteristic that crosses the boundaries of original industries and sectors [11].

3. The importance of cultivating humanistic quality for the construction of New Engineering Discipline

The traditional university engineering education has been called as engineering education in China, which has always been dominated by professional education, and humanistic quality has either been neglected or taken as a supplement, which is independent or incompatible with the engineering education, and this education mode often separates the spiritual core of both [12]. Thereby, resulted in a lack of humanistic qualities, a weak social knowledge, and a weakened aesthetic ability among the science and technology students [13]. However, the cultivation of humanistic qualities is essential to improve the overall quality of university students, therefore, the humanistic qualities are the core qualities in the New Engineering talents.

3.1. The quality of humanities can provide an intellectual foundation for the cultivation of complex talents in New Engineering Disciplines

Education is not simply the accumulation of knowledge, but also consist the enhancement of wisdom. In the current stage of rapid development of the knowledge economy, the concept of knowledge is changing from fragmented and non-systematic in the past to a complex and systematic integration. In the traditional mode of talent training, the students are taught to learn through the knowledge-based mode, the learning of scientific knowledge and technical methods is given absolute priority due to the dominance of the scientific and technical paradigms, thereby students can easily acquire knowledge, but not necessarily acquire wisdom through the learning process ^[14]. Unlike the specialized and standardized teaching methods of science education, humanities education implements a more dialogical and inspiring teaching method of ‘teaching people to fish’, which intensifies the training of students’ critical thinking, integrative thinking and creative thinking. Thus, it goes beyond general intellectual learning and focuses on enlightening the mind, enhancing thinking skills, and cultivating a sense of innovation. Humanities education helps students move from knowledge seeking for wisdom seeking at a higher level ^[15]. As American educator J. H. Schoeb mentioned, “The fundamental value of humanities courses for engineering students is to teach them a way to explore questions and perspectives different from those of the engineering disciplines; rather, these courses prompt students to think, and thereby promote the growth and development of their minds ^[16].”

3.2. Humanistic quality helps to cultivate the innovation ability of New Engineering discipline talents

According to the Fudan Consensus, the new concept of engineering education is actually to emphasize the cultivation of students’ inner thinking ability, which mainly includes the ability to create freely and the ability to work in teams. These two abilities cannot be acquired through the study of engineering technology, but can be learned through the cultivation of the humanities. The ability of free creation is the ability of creative thinking which is directly oriented to the free nature of human beings, and it is the bridge between the innovation and technical creation. The human being has unlimited possibilities of development, which is the freedom and creativity of human being, and this free creative potential is the inner driving force for the formation of innovative talents. Without the freedom of human creativity, it is impossible to develop new creative solutions when facing the complex and complicated real world. Creative activities include a variety of complex cognitive activities, and creative thinking, is the core of humanities disciplines such as, philosophy and art, which are undoubtedly a powerful way to cultivate human freedom and creativity. Innovation in the era of knowledge economy cannot be achieved without the assistance of a team, and the cultivation of team consciousness is also necessary for the formation of creative abilities. Education in humanities disciplines such as philosophy, political science, and history undoubtedly contributes to the cultivation of team consciousness ^[17].

4. The main path of cultivating humanistic quality of college students in the construction of New Engineering Discipline

As mentioned above, the cultivation of the humanities is essential and significant to the cultivation of talents in New Engineering discipline. However, in the current practice of higher engineering education in China, humanities education is often marginalized by universities, and the division between arts, science, and engineering is serious, thereby the phenomenon of ‘arts without science and engineering’ is quite common. A report from the School of Electronic Science and Engineering of Nanjing University points out, ‘the target orientation of engineering talents cultivation in China is not clear, where the relationship between humanities education and science education is vague, and engineering students have more shortcomings in comprehensive quality and knowledge structure’ ^[18].

First of all, as the main way for students to master humanities' knowledge and acquire humanities literacy, general education should increase, the reform of humanities in the general education courses in the future. Starting from several aspects, such as education mode, teacher training, teaching methods, and examination and evaluation, one should build a scientific humanities education curriculum system, cultivate a high-caliber humanities education teacher team, reform the classroom teaching form of humanities education, overcome the one-way education mode of full of lectures, and establish a student-oriented research-based teaching mode to help them internalize humanities knowledge into humanities literacy [19]. In addition, one should actively explore the multiple ways in forming the humanistic quality cultivation mode. For example, Wuhan University has explored and implemented the 'five paths and five classrooms' cultivation system for enhancing the humanistic quality in medical students, where the 'five paths' refers to general education courses, medical humanities courses, campus culture, lectures and forums, social practice, meanwhile, the 'five classrooms' refer to the physical classroom (the first classroom: classroom), LuoJia landscape (the second classroom: campus), the north and south of the Yangtze River (the third classroom: domestic), the east and west of the earth (the fourth classroom: international), and the virtual world (the fifth classroom: network) [20].

4.1. Explore a new model of humanistic quality cultivation

For a long time, in many science and engineering colleges and universities, humanities courses, mostly adopt one-way knowledge to transfer and theory indoctrination, in contract lacking in two-way interaction and emotional communication between the educator and the student, resulting in unsatisfactory teaching effects. Under the new situation, humanities education must reverse this passive situation, turn closed and modified the lecture-based learning into an experiential and cooperative open learning, and provide students with a personalized learning environment by building a new classroom with flipped and shared humanities education. The new humanities education classroom with flipped and shared style provides students with a personalized learning environment, further fully stimulates classroom vitality. In addition, we need to continue to explore new modes and forms of humanities cultivation, for example, try to use entrepreneurship education as a carrier to strengthen the students' humanities behavior practice, mobilize students' innovation enthusiasm, and consolidate the learning results of humanities. Further, guide the participation in scientific research projects as a channel to promote the humanities, encourage students' innovation projects to be combined with instructors' scientific research, additionally, the students can help instructors to relieve some of the pressure of scientific research affairs. The students can also enrich their humanistic knowledge and cultural literacy by communicating with their instructors, and help develop teamwork skills while training in scientific research [21].

5. Conclusion

New Engineering Discipline is a major strategic choice for engineering education reform in the context of new scientific and technological revolution and new economy, and a new way of thinking and development for future engineering education reform in China. Humanities quality constitutes the core quality of New Engineering talents, and humanities quality cultivation can consolidate the foundation of intellectual knowledge of New Engineering talents, further enhance their innovative ability. In the future, we need to build a complete humanistic quality cultivation system and explore a new mode of humanistic quality cultivation.

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