

Study on Talents Ability and Quality of Building Environment and Energy Engineering Major Based on Iceberg Theory

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ABSTRACT

In order to cope with the new round of scientific and technological revolution and industrial change, and to support the service innovation-driven development, the talent training mode of higher engineering education has been transformed from the traditional scientific paradigm to the engineering paradigm. "New Engineering" construction puts forward the new requests to the talent ability cultivation. The talented person ability quality deconstruction for the application ability, innovation ability and comprehensive quality, professional talents dominant power system is analyzed based on iceberg theory for Building Environment and Energy Engineering Major, Wuhan University of Science and Technology. It provides a reference for the formulation of professional talent training program and the implementation of teaching reform.

Keywords: *Iceberg theory, Talents ability and quality, New engineering, Building environment and Energy Engineering Major.*

1. CURRENT SITUATION OF HIGHER ENGINEERING EDUCATION IN CHINA

China's higher education is undergoing an all-round reform in its structural form, development mode, system and mechanism, ideology and goal system [1]. As an important part of higher education, higher engineering education is also in the process of deepening transformation. The development of higher engineering education in China can be divided into four periods, which are initial exploratory period, rapid development period, adjustment and optimization period, and innovation and development period [2]. Since 2017, with the release of "Fudan Consensus", "Tianda Action", and "Beijing Guidelines", China's higher engineering education has opened the prelude to the construction of "new engineering". In recent years, the research and practice on the new concept of engineering education of "new engineering", the new structure of discipline and specialty, the new mode of talent training, the new quality of education and teaching, and the new system of classified development have been comprehensively promoted from three levels of macro strategy, medium strategy and micro strategy. On one hand, higher engineering education has changed from

the extensional development mode to the connotative development mode focusing on improving the quality of personnel training. On the other hand, the higher engineering education has changed from the traditional emphasis on engineering science and basic education to the engineering practice education, from the emphasis on training engineering scientists to the emphasis on training engineers, and the talent training paradigm of higher engineering education has changed from the traditional scientific paradigm to the engineering paradigm.

2. BACKGROUND OF NEW ENGINEERING IN MAJOR OF BUILDING ENVIRONMENT AND ENERGY ENGINEERING

As a basic unit of talent training, major is also the main practice carrier of engineering education talent training paradigm. Engineering specialty construction is a value-oriented practice process to meet social needs and talent training objectives. The construction of "new engineering" is just to actively respond to the new round of scientific and technological revolution and industrial change. Supporting a series of national strategies, such

as innovation-driven development in services, "Made in China 2025" and "Industry 4.0".

As an important support for the cultivation of senior talents and the development of science and technology in the field of civil engineering, the major of building environment and energy application engineering plays an important role in the development of national economy and society. In 1998, "Heating and Supply Gas Ventilation and Air Conditioning Project" and "Urban Gas Project" were merged and adjusted into "Building Environment and Equipment Project". In 2012, "Building Intelligent Facility" and "Building Energy Saving Technology and Engineering" were included into the major of Building Environment and Equipment Engineering in the catalogue of undergraduate majors of ordinary institutions of higher learning, and the professional scope was extended to the fields of Building Environmental Control, Urban Gas Application, Building Energy Saving, and Building Facility Intelligent Technology. The major name is adjusted to "Building Environment and Energy Application Engineering Major". Built ring to expanding professional denotation and connotation, by professional development initial period only focus on the thermal environment, such as heating, ventilation, air conditioning requirements and regulation to the present stage green, low carbon, high efficient and intelligent building environment and energy supply systems, the discipline foundation across civil engineering, architecture, environmental science and engineering, engineering thermal physics 4 first-level discipline. It covers the knowledge and content of architecture, energy, environment, human health, engineering economy, intelligent control and other fields, showing the characteristics of interdisciplinarity, crossover, comprehensibility and practicality. In 2002, the major of construction and environmental protection began to enter the professional evaluation of civil engineering discipline organized by the Ministry of Housing and Urban-Rural Development. In 2017, the Ministry of Education launched and promoted the construction of new engineering in an all-round way, and the Building Environment and Energy Engineering Major was listed as a new engineering major, providing new opportunities for the further development of the major.

3. OBJECTS OF TALENTS ABILITY AND QUALITY TRAINING OF MAJOR OF BUILDING ENVIRONMENT AND ENERGY ENGINEERING

The main task of the Building Environment and Energy Engineering Major is to make full use of natural energy and build an appropriate human living environment and an appropriate technological environment with the lowest energy consumption, as well as artificial environment for special application

fields such as underground engineering environment, national defense engineering environment, and the interior space environment of vehicle [3]. With the continuous improvement of human living standards, people's pursuit of a better, comfortable and healthy life continues to improve, and the indoor environmental quality standards of buildings are also increasing day by day, which leads to a significant increase in the demand for professionals in environmental construction. As "Internet +", "big data", "cloud computing", the development of the "artificial intelligence" and "carbon peak, carbon neutral" vision, to develop in line with national and industry innovation driven development strategy, help to new technologies, new forms and new industries and new mode of professional talents for the characteristics of the new economy, is the era have entrusted to build professional responsibility. In this context, the ability and quality training objectives of environmental construction professionals are the primary issues that need to be clarified in the process of personnel training.

Wuhan University of Science and Technology is a teaching and research university with engineering focus, coordinated development of multi-disciplines and distinctive characteristics of metallurgy. Based in Hubei Province and facing the whole country, the school provides talent and intellectual support for the construction and development of metallurgy, manufacturing and other industries. Focusing on the overall goal of "steel quality, social talents", the school aims to cultivate high-quality applied talents with all-round development of morality, intelligence, physical education, beauty and labor, solid basic theory, reasonable knowledge structure, strong social adaptability, rich practical ability, innovative and entrepreneurial spirit, and a certain international perspective. At present, the country is implementing the "One Belt And One Road" strategy, and it is in urgent need of a large number of high-quality applied talents with international vision and innovative practical ability. The "Rise of Central China Strategy", the construction of the Yangtze River Economic Belt, and the construction of Wuhan as a "National Central City" have driven the rapid development of Hubei Province and the vast central region, which requires a large number of applied talents in the fields of industrial and civil, underground and above ground building environment construction, energy planning and application. At the same time, with the upgrading and transformation of China's construction industry, the practical application of a large number of new technologies and new methods, as well as the complexity and diversity of projects, the industry and enterprises urgently need a large number of solid theoretical foundation, broad professional knowledge, and strong practical and innovative ability. High quality applied talents with international vision, high sense of

social responsibility, good engineering professional ethics, team spirit and comprehensive ability to solve complex engineering problems.

Wuhan university of science and technology aims to build ring professional cultivation of morality, intelligence and physique, us, fatigue all-round development, has a good base for the natural sciences and humanities and social science, have computer and foreign language application ability, master the building environment and energy application of relevant basic knowledge and basic skills, basic training for engineers, and has a certain ability to innovate and internationalized vision, high-quality application-oriented talents who are engaged in technical or management work such as planning and design, research, design and manufacturing, construction and installation, operation management and system support in the fields of heating, ventilation, air conditioning, purification, cold and heat source, gas and so on.

4. ICEBERG MODEL OF TALENTS ABILITY AND QUALITY OF MAJOR OF BUILDING ENVIRONMENT AND ENERGY ENGINEERING

American psychologist David McClelland put forward the famous "Iceberg Model" in 1973, which described individual abilities as an iceberg and divided them into two different forms, namely, the "upper part of the iceberg" above the water and the "lower part of the iceberg" under the water. The "upper part of the iceberg" is called the explicit ability, which includes the basic knowledge and skills. It is the external expression, easy to understand and measure, and easy to improve and develop through the teaching process. The "underside of the iceberg" is called implicit competence,

including social role, self-image, trait and motivation. It is an internal index of competence that is difficult to be measured, and it is not easy to be changed by external influence, but it plays a key role in people's behavior [4].

Under the new engineering background, the dominant and recessive abilities of talents in environmental engineering specialty are composed of three parts: application ability, innovation ability and comprehensive accomplishment. As shown in Table 1, for the explicit ability system, the application ability includes design and development ability, modern tool application ability, engineering practice ability and engineering project management ability. The innovation ability consists of innovation consciousness, innovation thinking and innovation method. Comprehensive literacy consists of humanities and social sciences literacy, professional ethics literacy, social responsibility, team spirit, and international vision. For the recessive ability system, the application ability includes the consciousness of engineering ethics, engineering thinking and the consciousness of sustainable development of engineering and environment. Innovation ability includes innovation motivation and innovation potential. Comprehensive literacy includes systematic social participation ability, lifelong learning ability, cross-cultural communication ability, policy and regulation interpretation ability, and leadership ability of professional leaders in multidisciplinary teams. The goal of talent cultivation of this major is to continuously improve the explicit ability of students and stimulate and explore the implicit ability of students.

Table 1. Iceberg model of talents ability and quality of Building Environment and Energy Engineering Major

Classification	Dominant ability	Recessive ability
Application ability	Design and development ability, Modern tools utilization ability, Engineering practice ability, Engineering project management ability	Engineering ethics consciousness, Engineering thinking, Consciousness of sustainable development of engineering and environment
Innovation ability	Innovation consciousness, Innovation thinking, Innovation methods	Innovation motivation, Innovation potential
Comprehensive quality	Literacy in the humanities and social sciences, Professional ethics, Social responsibility, Team consciousness, International vision	Social participation ability, Lifelong learning ability, Ability to communicate across cultural backgrounds, Ability to interpret policies and regulations, Leadership in a multidisciplinary team

5. CONCLUSIONS

The construction of new engineering puts forward new requirements on the composition and cultivation of the ability and quality of the talents of building environment and energy application engineering. Talents training must conform to the needs of society, promote the transformation of scientific paradigm to engineering paradigm, reconstruct the structure of talents' ability and quality, and stimulate students' implicit ability while improving students' explicit ability, so as to cultivate outstanding talents who can solve complex engineering problems innovatively.

AUTHORS' CONTRIBUTIONS

Min Chen contributes to investigation, conceptualization, methodology and original draft writing. Chunzhi Zhang, Donghua Liu and Qianjun Mao contribute to editing and revision.

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