Exploration and Practice of Avoiding "Engineering Scientification" in Undergraduate Vocational Education

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Abstract: Engineering has independence. Engineering is not the application of science and technology, nor is it a subsidiary of them. The current engineering education system needs to be reformed. Engineering activities integrate a large number of engineering elements with different properties into a specific functional engineering entity, and must be organized according to the theories and methods of systems science. We need to strengthen the basic training of science subjects such as mathematics, physics, and chemistry for engineering students. Avoid scientificization in engineering evaluations. COMET evaluates technical solutions from eight aspects: intuitiveness, functionality, value orientation, economy, work process orientation, social acceptance, environmental friendliness, and creativity, in order to evaluate the functional abilities of the subjects. All of these provide an implementation path to avoid the "engineering oriented" approach.

Keywords: undergraduate vocational education; engineering ontology; COMET

Introduction

Based on the epistemology that "technology is the application of science, and engineering is the application of technology", the current order of the training system for engineering majors at all levels and types of vocational education is: scientific foundation - technical foundation - engineering foundation - graduation project. People firmly believe in this and rarely reflect on it [1][2].

In fact, engineering has independence. Engineering is not an application of science, nor is it a subsidiary of science. From a historical perspective, engineering activities existed in primitive societies, while scientific activities only had a brief history of several thousand years. For a long time in history, engineering activities did not rely on the discovery of scientific principles, and even the first industrial revolution was not the result of the "push" of scientific theories.

In recent years, some people have suddenly been surprised to find that there is a phenomenon of "detachment from reality to virtuality" and "engineering and science oriented" in vocational education, and these engineering graduates cannot meet the needs of engineering construction. Personnel from various industries have engaged in a series of discussions and come up with ideas. Vocational undergraduate education, in particular, should overcome the inertia of "undergraduate education" and take effective measures in the process of talent cultivation to avoid the emergence of "engineering and science oriented".

1 Cultivation of science knowledge for engineering students

For engineering students, scientific knowledge is an indispensable foundation for mastering engineering science, and can only be strengthened rather than weakened. Science refers to the collective term for formal science and natural science. Mathematics belongs to formal sciences, while natural sciences include physics, chemistry, biology, and so on. Engineering science is the science that links scientific knowledge with engineering technology [1].

1.1 Content of engineering science

Any project always requires a variety of interdisciplinary knowledge and technologies. Engineering science starts with the overall goal of engineering, comprehensively considers various constraints, and then repeatedly optimizes the process through analysis integration, integration analysis, and so on. A project needs to integrate multiple technical systems and elements, as well as non-technical factors such as resources, capital, land, labor, and market. To pursue the optimal configuration of different engineering elements and processes, with minimal investment in personnel, finance, materials, and information, to achieve maximum economic and social benefits.

1.2 Characteristics of engineering science

Engineering activities integrate a large number of engineering elements with different properties into a specific functional engineering entity, and must be organized according to the theories and methods of systems science. Engineering activities add social and cultural complexity to the complexity of natural things, requiring the study and handling of various factors, and have complex scientific characteristics.

Engineering science has interdisciplinary characteristics. The interdisciplinary field in engineering needs to address the intersection of natural sciences and social sciences, technical sciences and humanities, and mathematics and social sciences. Engineering starts from the existing basic scientific theories, integrates the theoretical provisions and laws of different disciplines according to human social goals, and objectifies them into an artificial creation.

1.3 The science foundation of engineering science

Natural science is the theoretical foundation of modern engineering activities, and both engineering technology and engineering science are based on natural science. Engineering science must follow scientific theories and conform to the basic principles and laws of natural science. All engineering activities and all aspects of engineering activities cannot be separated from or violate natural science.

Strength analysis and structural optimization in engineering a ll involve advanced mathematics knowledge, including limit thi nking, differential and integral thinking in advanced mathematic s, especially partial differential, to help engineering students bet ter understand and understand the natural world. Linear algebra embodies the connection between geometric concepts and algeb raic methods, and its determinant and matrix tools are widely us ed in mathematics, mechanics, physics, computer-aided design, virtual reality, and other technologies. The concepts embodied i n mathematics, such as axiomatic assumptions, axiomatic metho ds, induction and synthesis, and logical reasoning, are very bene ficial for strengthening people's engineering thinking.

Physics mainly studies topics such as force, heat, sound, light, electricity, atoms, etc. It mainly teaches the basic structure and interactions of matter, as well as the most basic and common for ms of motion and transformation laws of matter. All fields in na tural science and engineering activities cannot do without the la ws of physics. Engineering chemistry is the discipline that studi es the properties, structures, changes, and synthesis of substance s. In fields such as materials science, manufacturing processes, environmental engineering, and energy research, these issues all require chemical knowledge to solve.

2 The path of avoiding "engineering and scientification"

The management personnel and frontline teachers of vocational education institutions are mostly promoted to the vocational edu cation podium through receiving regular undergraduate educatio n. Due to the inertia of undergraduate education, vocational coll eges attach importance to paper publication and neglect practica l innovation in the production line. The evaluation system for v ocational education teachers is like this, and the conditions for u ndergraduate and master's graduation are formulated accordingl y. Some people believe that there is a serious phenomenon of sc ientization in Chinese engineering education based on this.

The business and academic communities have already taken a ction to explore beneficial paths for cultivating engineering tale nts suitable for social needs. The theoretical framework of the " Five Theses" in engineering philosophy and the evaluation of pr ofessional abilities, COMET, provide powerful guidance for bre aking the "scientific transformation of engineering" [3] [4].

2.1 ENGINEERING ONTOLOGY

In ancient times, people always consciously or unconsciously b uilt projects to adapt to nature, and then summarized invention t echniques and techniques, as well as discovered scientific princi ples, to further guide better construction projects. Any project is carried out under certain natural environment (conditions). In o rder for engineering activities to succeed, they must follow natu ral laws and be carried out within the range that the natural ecol ogical environment can bear.

Engineering Examples (Casting).

The "Chinese College Student Mechanical Engineering Innovation and Creativity Competition: Casting Process Design Competition", sponsored by the China Society of Mechanical Engineering and organized by the Casting Branch of the China Society of Mechanical Engineering, requires participants to start from two-dimensional drawings and submit design specifications. The main contents of the works include: part names, material requirements, structural analysis, main production technology requirements (shape, melting, casting, heat treatment, etc.), process plans, and process descriptions Parameters, process diagrams and tables (cards), casting quality control (preventive measures for defects), etc. These are all engineering requirements for a casting enterprise to produce high-quality castings.

2.2 COMET MODEL FOR OCCUPATIONAL COMPETE NCY

assessment

The COMET (Competence Measurement) model for assessing p rofessional competence and professional identity is an internatio nal collaborative project based on modern vocational education theory. It establishes a professional competence model and asse ssment model, and conducts rigorous psychological measureme nt technology verification. Not only can it be used to diagnose t he professional ability level of students, but it can also evaluate the overall situation of professional identity and commitment [7].

3 Result and discussion

Engineering should avoid being science oriented. Engineering s hould attach importance to application and practical innovation, while science should attach importance to basic research and the oretical innovation. The evaluation of engineering should focus on the practical application of scientific research achievements and technological breakthroughs and innovations.

The COMET assessment of occupational ability and occupati onal identity can diagnose the level of occupational ability of en gineering students, and can also evaluate the overall situation of occupational identity and commitment. It is a powerful tool for engineering to avoid scientification.

4 Conclusion

Based on the ontology of engineering, the current order of traini ng engineering students in the fields of "Science Fundamentals - Technical Fundamentals - Engineering Fundamentals - Graduat ion Design" is unreasonable. For engineering college students, we should strengthen their knowledge of science rather than we aken it.

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