

The Comprehensive Engineering Education to Cultivating "Top-Notch" Engineers

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Abstract: *We advocate comprehensive engineering education and integrate Civic Education with vocational education. Cultivating future engineers is the professional mission of college teachers in engineering in the new era.*

Keywords: *Comprehensive engineering education; civic education; engineering majors in the new era; engineering ability cultivation*

1. Introduction

The world today is undergoing a great change unprecedented in a century, and China is in a critical period of achieving the great rejuvenation of the Chinese nation. Patriotism in the new era has new requirements for us again. We advocate comprehensive engineering education, and combine Civic Education with vocational education. It is the professional mission of the teachers of engineering colleges and universities in the new era to cultivate future engineers who will stand on top of the sky and stand on the ground[1-2].

2. Engineer education should keep up with industry trends and advocate for comprehensive engineering education

Engineering and engineers have become a major force for human survival, development and achieving a better life. The content of comprehensive engineering education involves a comprehensive knowledge of the engineering field. Not only pays attention to the development of professional knowledge and professional skills, but also focuses on the overall improvement of students' social adaptability and personal qualities.

To better integrate students into social work, we advocate an education oriented to engineering practice. The school initiates educational project cooperation with large domestic enterprises and deepens students' impressions of cognitive internship and construction internship. Students' understanding and application of surveying techniques are improved through practice in surveying practice bases. Based on the advanced training concepts such as "cooperation in school system, cooperation in science and technology innovation, and cooperation in 3+1 talent training", the school takes the cooperation between industry and academia as the way to strengthen the school. We have established an engineering training center with advanced equipment and comprehensive capabilities to improve the hands-on ability of engineering students and cultivate the habit of "testing the truth by practice".

In order to break through the bottleneck of technology, engineering education should always keep close to the frontier of science. The teaching of civil engineering should be integrated with emerging fields such as information, new materials and advanced manufacturing. Making full use of the network enriches the means to learn scientific knowledge, establishing a virtual simulation platform can help students master skills at school.

The innovation storm is rising in China. Advocate engineering innovation education. With the rapid development of China's economy, unprecedented super projects are popping up all over the place. However, China is a vast country with unique geographic and climatic conditions that make civil engineering design and construction more difficult than ever. This requires Chinese engineers to have a strong sense of responsibility such as breaking through technical barriers with innovation, and creating innovative design with Chinese characteristics[3-4].

Students should be encouraged in constantly trying and finding for the best solutions, innovative ability will be developed in cross-fertilization between teaching and research. By leading the way of research and cultivating the methods, a sense of innovation will be developed.

3. Fostering self-identity among engineers

Craftsmanship refers to individual artisans carving their own products and striving for excellence, which is the process to elaborate with a faith of perfect. The great artisans show their passion for working, diligence for learning and dedication for manufacturing. Therefore, craftsmanship encourages students nationwide to work hard, be innovative and pioneering, and keep improving their techniques and skills in order to contribute their wisdom and strength to advancing the country's high-quality development, comprehensively building China into a modern socialist country. With a sense of responsibility, engineers carefully design each program. Rely on team cooperation, engineers carefully solve each problem encountered. Every bridge and every building is the result of teamwork.

Through personality exploration and self-exploration, help students fully affirm their own value. Through the exploration of vocational interests, help students to establish a good cooperative relationship. Then cooperation and self-confidence are constantly growing in the hearts of students[5-7].

Craftsmanship is a valuable attribute in engineering that can be illustrated through practical examples. One such example is the Shanghai LUPU Bridge, which is constructed using a fully welded steel box girder structure. During the assembly process, each section is bolted together, and then skilled craftsmen are required to perform manual welding at high altitude, within the narrow confines of the steel box girder, under high temperature and in a suffocating environment. This case highlights the artisan spirit of meticulousness, the pursuit of excellence, and hard work. Such an approach to work enables students to learn new knowledge and operating skills, improve their comprehensive literacy, and establish a correct outlook on life and values.

Through this example, students can understand the challenges faced in actual operation and the courage of engineers to face challenges without fear of hardship and danger. They can also appreciate the importance of social responsibility and noble spirit in the pursuit of excellence in engineering. Thus, students can develop a deeper understanding of the frontier applications of science and technology, while also learning the practical skills needed to become a "craftsman". By emphasizing the importance of meticulousness, excellence, hard work, social responsibility, and a noble spirit, students can be inspired to become skilled engineers who contribute positively to society.

4. Engineering education should focus on basic disciplines

The "New Engineering Education Program" aims to sow the seeds of an engineering culture throughout society. For engineering students, the curriculum serves as the bridge between their personal aspirations and their future careers. It is our responsibility to instill a sense of social responsibility in our students and cultivate engineers who will fulfill their ethical obligations. In designing our curriculum, we prioritize developing students who value life, respect the law, and prioritize public interest in industry. We emphasize the importance of dedication and excellence in professional skills, as well as leadership and teamwork skills. By analyzing real-life accidents and their causes and consequences, we aim to further enhance students' social responsibility.

The mathematics and mechanics courses in higher education are oriented to the entire engineering discipline, but they need to be expanded to adapt to the development of different professions. For example, we should integrate advanced mathematics and data processing. With the help of advanced programming software, such as Mathematica, MATLAB and Maple.

Mechanical thinking is a hybrid thinking in terms of thinking development. For students of civil engineering, Water Conservancy, bridges and tunnels, aerospace, railways, materials, the cultivation of thinking style requires them to have a sensitive of imagination intuitively, which belongs to the concrete thinking. For mathematical derivation, however, it is the imaginative way to develop students' abstract thinking and to develop the ability of rigorous logical derivation. The study of mechanics is precisely to reconcile these two ways of thinking, so that engineering and mathematics become the same thing and respond to the same real world.

When teaching English as a foreign language, we should get students used to expressing their work and their appreciation of the team. This will not only internationalize the students' work, but also bring

international expressions into the classroom[8-12].

5. Promote the spirit of patriotism and go to the stage of international engineers with more perfection

In the new era of reform and opening up, engineer education is no longer satisfied with the acquisition of knowledge. More importantly, engineer education is the conception guidance such as understanding, truth, practice and methodology. It has become the objective requirement of engineer education to perfect personality, sublimate personal cultivation, and promote the spirit of patriotism. Nowadays more and more engineers go to the stage of international with a perfect attitude.

Taking the advantages of classical architecture in civil engineering, cultural history is introduced into courses. In our curriculum, we leverage the features and benefits of classical architecture, integrating cultural history and promoting cultural self-confidence and patriotism among students. We aim to cultivate their national pride and instill a sense of national identity through the illustrious accomplishments of China's ancient past. Students will come to appreciate that the Chinese nation has emerged as a global powerhouse due to its extensive 5,000-year-old history and that Chinese culture has nurtured its sons and daughters.

The philosophical ideas and cultural values inherent in professional courses are transformed into effective teaching tools to concretize and vivify socialist core values. This integration of spiritual guidance with silent knowledge learning establishes a seamless and organic relationship between them. For example, the debate among experts regarding whether a structure should be rigid or flexible and what degree of rigidity or flexibility is appropriate has been resolved with the consensus that designers pursue both qualities. Rigidity provides the foundation, while softness protects the body. The stiffness of the structure is limited, hence the principle of "softness overcomes rigidity" which consumes and transforms external forces by enhancing energy consumption ability. The common linkage members play this role. Flexibility is the law of protection, but must be controlled within a tolerable range to prevent essential functions from being lost.

The theory of rigidity and flexibility is widely used to achieve excellent structural design. For example, the design of high-rise structures for wind resistance and seismic performance is originally contradictory. Seismic design requires flexibility, while wind design requires rigidity. How can an engineer design a high-rise structure with good wind and seismic performance? The Bank of America building, designed by Lin & Tung-Yan, is a prime example of combining rigidity and flexibility. Rigidity is achieved through the barrel-in-barrel structure, formed by dense columns and deep beams, and internal shear walls to resist horizontal forces. Flexibility is achieved by controlling the yielding and damage of connecting members between subsystems, thus forming a ductile system. When each subsystem works independently, the self-oscillation period of the structure becomes longer and the damping increases, so that even if the elastic limit is exceeded, it still maintains plastic strength and can be swayed without collapsing.

In the process, cultural confidence and the patriotism spirit were deeply imprinted in the students' hearts. At the same time, national pride and sentiment were built in the students' mind through the great achievements of China[13-14].

6. Conclusion

In the past 20 years, we are glad to see that the quality of higher education has made great progress. Meanwhile in China. With the largest scale in the world, the quality of engineering education has been made constantly improving. It not only plays a key role in the development of high-quality higher education, but also facilitates the realization the Chinese dream of great Chinese nation rejuvenation. In the next 10-20 years, China will achieve China's innovative development with a large number of economical scientific and technical talents. The Chinese engineer dividend will lead the world development trend. Advocating comprehensive engineering education can promote patriotic spirit & build cultural confidence, as well as develop engineering capabilities.

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