

## **Study on expanding innovation fields for engineering personnel by utilizing multidisciplinary advantage of comprehensive universities**

Zhi Cao

Hebei University, Baoding, 071002, China

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**Abstract:** currently, transitional development of engineering industry leads to urgent demand for interdisciplinary personnel. Meanwhile, employment pressure of students majoring in engineering in comprehensive universities is also on the rise. The contradiction between the two becomes increasingly prominent. Thus, it is required to utilize multidisciplinary advantage of comprehensive universities to continuously expand innovation fields for engineering professionals. This paper expounds the urgency of giving play to multidisciplinary advantage of comprehensive universities for engineering personnel training innovation and proposes methods to utilize multidisciplinary advantage of comprehensive universities to expand innovation fields for engineering personnel.

The essence of expanding innovation fields for engineering personnel by utilizing multidisciplinary advantage of comprehensive universities lies in promoting reform and innovation of university engineering education so as to boost innovative personnel cultivation quality of Chinese higher engineering education, form a new system of Chinese higher engineering education and accelerate transformation to a strong country of higher engineering education from a large country of higher engineering education. Thus, comprehensive universities should give full play to their multidisciplinary advantage, practically change higher education concept, over drive the course of engineering personnel reform and be devoted to exploring new fields for innovative cultivation of engineering personnel.

### **I. Urgency of giving play to multidisciplinary advantage of comprehensive universities for innovative engineering personnel cultivation**

Through visiting numerous engineering enterprises, the author finds their infrastructure construction development is characterized by new type, informatization and internationalization, which is mainly reflected in surveying planning, automated construction, informatization management and new material application. Meanwhile, to respond to the above changes and meet the demand of declaring new high-tech enterprises, most enterprises are actively implementing technical transformation, transformation and upgrade. These are mainly reflected in upgrade of important technology, transformation of main equipment, implementation of modern management and cultivation of new engineering personnel. Thus, it is necessary to cultivate innovative personnel and make them participate in technical transformation, transformation and upgrade so as to adapt to new development trends of engineering industry. Of course, rapid development of infrastructure construction in China also needs a large number of high-quality engineering personnel. So, employment rate of engineering graduates from comprehensive universities is quite high. However, due to the arrival of the era of higher education popularization, new changes gradually occur in employment market of engineering graduates. Since employment situation of engineering-related specialties becomes more and more severe, employment pressure of graduates also become increasing heavy. One prominent contradiction is the contradiction between the large gap for innovative personnel in transformation and upgrading process of employers and increasingly severe employment situation for university students. An important cause is that current engineering personnel cultivation method of comprehensive universities still pays attention to traditional structural engineering knowledge. Thus, course teaching and practice contents have a huge gap with new, information-based and international development of this industry. The demand of enterprise technology upgrade for engineering professionals cannot be achieved. Thus, engineering graduates

from comprehensive universities are mismatch with employment market. In view of this, comprehensive universities should utilize their multidisciplinary advantage to spare no effort to explore and implement a new mode to cultivate engineering personnel with multidisciplinary advantage.

## **II. Methods to expand innovation fields for engineering personnel by utilizing multidisciplinary advantage of comprehensive universities**

### **(I) To specify engineering personnel training orientation**

During positioning engineering personnel cultivation objective, comprehensive universities must explicitly differentiate various fields corresponding to personnel demands so as to avoid personnel employment mismatch, better satisfy needs of engineering specialty and improve employment quality of engineering personnel. Based on a survey, the jobs needing strong technical operation ability demand a large quantity of vocational college students majoring in engineering. This quite accords with vocational college students owning strong application ability. The enterprises with R&D nature need a large number of postgraduates. Undergraduates in comprehensive universities own strong plasticity and are still the main force for the vast majority of employers. However, it is required to strength compound advantage of multidisciplinary to really meet the demand of fast food industry. Based on this, it is necessary to cultivate comprehensive quality, cooperative consciousness, learning ability, psychological quality, communication and coordination ability, innovation ability and critical thinking skills. Universities should carry out various questionnaire surveys of employers and gain detailed situations about engineering personnel demand with AHP so as to effectively master relevant information needed by engineering teaching and employment guidance, penetrate engineering personnel cultivation objective in classroom teaching, make sure innovation quality of engineering personnel can improve well and boost employment pertinence.

### **(II) To enhance cultivation of basic knowledge and professional skills of engineering personnel**

International and interdisciplinary modern engineering personnel should not just own quite solid basic knowledge, but also have very high professional skills. For the former, comprehensive universities can not merely establish and perfect high-quality teaching teams in a short term, but also give full play to their multidisciplinary advantage, transfer excellent teachers from other schools and departments to make sure foundation course teaching of engineering specialty can be smoothly carried out and that teaching quality can improve stably. In foundation course, superior course standards should be applied to construct main courses of engineering specialty. Besides, good courses can be selected for applying for excellent courses. Meanwhile, it is also required to actively construct some bilingual model courses and promote professional quality of university students on the basis of teaching link. For the latter, it is required to strive to construct a batch of practice bases to make engineering students learn practical skills, implement the plan of “excellent engineers in classroom” and invite high-skilled personnel with practical experience in large enterprises to undertake teaching tasks of relevant courses in order to boost students’ practical operation ability and professional skills.

### **(III) To strength cultivation of foreign language competence and communication ability**

As continuous industrial development in the world, industry has become one of industries with the highest internationalization degree. International cooperation, exchange and competition are continuously on the rise. Thus, new higher requirements are put forward for practitioners. To enhance English teaching and improve their English skills is also a significant step to cultivate international personnel and interdisciplinary personnel. On this basis, firstly, original course system related to engineering specialty should be practically adjusted and optimized. Apart from guaranteeing original foundation of university students and professional English teaching, backbone courses of engineering specialty should be equipped with bilingual textbooks. Besides, it is required

to explore bilingual classroom teaching as far as possible so as to facilitate improvement of foreign language competence in practice link. Bilingual elements should be added in examination, experiment and graduation project of engineering personnel to improve their spoken language, writing and professional foreign language competence. Secondly, it is required to actively encourage and support undergraduates majoring in engineering to intern and practice in enterprises with international background so as to enhance their English skills and communication ability.

#### **(IV) To intensify cultivation of humanistic quality and management ability**

Generally speaking, undergraduates majoring in engineering of comprehensive universities will relatively neglect cultivation and improvement of humanistic quality. Similar courses set are very limited. Modern engineering enterprises need those professionals who not only own solid professional knowledge, but also are familiar with laws and proficient in operation and management, and know relevant humanity, history and customs. This is also an inevitable requirement for international development of engineering specialty. Firstly, as market economic integration trend continuously enhances worldwide, all economic activities should be subject to laws, regulations and market rules. Thus, international professionals should know corresponding international economic laws and regulations as well as current policies in China. Secondly, engineering construction owns high input, large risks and good income. In particular, high technical content, difficult work and multi-disciplines are often involved in protection links. This requires undergraduates majoring in engineering to own strong professional skills and organizing ability. In other words, a large batch of professionals with solid professional basic knowledge who are familiar with economic evaluation and management is needed to implement scientific decision-making. Thus, based on ensuring smooth implementation of main course teaching of engineering, it is required to add some optional courses about humanity and laws as far as possible so as to promote undergraduates to be familiar with current international competition and cooperation, master corresponding international regulations and local laws and avoid unnecessary loss due to insufficient humanistic quality.

#### **(V) To enhance professional spirit training and cultivation**

Engineering construction is a comprehensive specialty involving various aspects and belongs to a tough industry. So, once one has no healthy body and the ideal of devoting himself to engineering career, the requirements for cultivating interdisciplinary professionals cannot be achieved. Therefore, university graduates majoring in engineering must own favorable political quality, ideological quality, physical quality, psychological quality and moral cultivation. Cultivation of these aspects should be conducted in four-year campus life. University graduates majoring in engineering are required to fully experience and feel characteristics of engineering specialty and campus culture. Course teachers should not just preach, but also teach by personal example as well as verbal instruction with good professional ethics so as to facilitate improvement of their professional spirit.

#### **(VI) To implement supporting policies and innovate teaching management**

In accordance with standardization and scientization objective of engineering personnel classroom teaching management, comprehensive universities should set up teaching management system composed of numerous teaching management documents. Teaching management system mainly includes teaching team building, teaching reform, quality monitoring, practice teaching and daily management etc. It is required to form guarantee mechanism adapting to education and teaching reform through establishing organization, system, teacher resource, fund and quality guarantee systems. Comprehensive universities should set specialty construction funds, teacher development funds and practice funds used for specialty construction, teaching team building and engineering practice projects for university students. Comprehensive universities should provide capital support for teacher resource, students, courses and projects from macroscopic aspect to

microcosmic aspect so as to provide strong fund guarantee for reforming engineering personnel cultivation. To be more specific, innovation should be conducted in the following fields: firstly, innovate performance allowance system. Comprehensive universities should carry out performance allowance distribution system for engineering specialty suitable for their actual conditions to form an appraisal mechanism linking with workload of professional teachers, evaluation results, teaching and research indexes. Secondly, innovate course teacher selection system. Engineering specialty managers can utilize multidisciplinary advantage of comprehensive universities to select excellent teachers to teach foundation courses. For those foundation course teachers whose teaching ability fails to comply with needs of higher engineering education, corresponding teaching tasks should not be arranged for them. Besides, excellent teachers of other universities can be invited for teaching according to the procedure. Their remuneration is paid according to class hour standard of part-time teachers. University students can freely select engineering specialty practice to guide teachers. The number of students selecting teachers will directly influence teachers; workload and evaluation results as well as their performance allowance and professional title appraisal qualification. Thirdly, innovate practical training system for engineering specialty teachers. Comprehensive universities should specify that engineering specialty teachers have to complete at least half-year engineering practice experience within the period of professional title appraisal. Fourthly, innovate diversified evaluation system. In examination and evaluation link of engineering courses, it is required to boldly break obsolete evaluation criteria and avoid judgment with the same method. It is required to detail total objective into numerous requirements in teaching links according to features of teaching contents and formulate ability-oriented evaluation system for undergraduate majoring in engineering. For team practice course represented by Engineering Practice, standard management platform can be developed to take charge of recording labor division of team engineering practice and progress in the whole process so as to guide teachers and employers to carry out in-time tracking and monitoring so as to perfect diversified whole-process assessment combining grading by teachers, grading by employers and mutual evaluation by students. Another type of courses is computer courses represented by C Language. It is required to apply module examination form to enhance examination of application ability, pay attention to programming standardization. Each module adopts independent assessment and comprehensive scoring form. Without limit for examination times, students only need to pass examinations of all modules in course learning period. Besides, ability evaluation system should be established.

### **III. Conclusions**

In conclusion, expansion of engineering personnel innovation fields with multidisciplinary advantage of comprehensive universities can highlight features of engineering specialty. Enhancement of multidisciplinary penetration can effectively improve comprehensive ability of university students, cultivate them to own various characteristics needed by interdisciplinary personnel to promote their competitive capacity for employment. Meanwhile, comprehensive universities should strengthen teaching transparency of engineering specialty to shorten the distance between employers and universities, expand innovation fields for engineering personnel cultivation and better improve employment status of engineering graduates.

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