ISSN: 2710-0170

Shortcomings and Improvement Suggestions of College Teachers in Engineering Education

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Abstract

Effective teaching of engineering-course in universities is a core bridge connecting scientific theory and industrial practice, requiring teaching staff to have a strong professional background and practical experience. However, the current training outcomes of engineering talents in universities are not satisfactory. This article summarizes and analyzes the problems faced by college teachers in engineering-course teaching, such as lack of engineering background, weak engineering awareness, slow professional knowledge update, outdated knowledge systems, and insufficient engineering teaching experience, and puts forward effective improvement plans and suggestions to address these issues.

Keywords

College teachers; engineering courses; engineering consciousness; teaching practice.

1. Introduction

Engineering education, as an important part of the higher - education system, is the core link connecting engineering scientific theory and industrial practice, and plays an irreplaceable role in the national industrialization process and scientific and technological innovation and development. Further strengthen science education and engineering education, and strengthen the independent cultivation of top-notch innovative talents to provide talent support for solving the key and core technical problems in China. At present, China has built the largest engineering - education system in the world and is in a transformation period from scale expansion to quality improvement. The teaching of engineering courses in universities is the core carrier for achieving the talent - training objectives of engineering education, and plays an important role in cultivating engineering talents, supporting industrial development, and enhancing national competitiveness. The teaching quality of engineering courses is directly related to the effectiveness of talent training in China. This article will analyze and discuss the deficiencies in the teaching of engineering courses from the perspective of college teachers and put forward effective improvement suggestions.

2. The Current Situation of Teaching in Engineering Courses at Universities

With the continuous advancement and optimization of China's industrialization process, as well as the transformation from "Made in China" to "Created in China", the country has continuously put forward higher requirements for talent training. Since the founding of the People's Republic of China, China's engineering education has gone through three development stages: the "technical paradigm", the "scientific paradigm", and the "engineering paradigm", and has built the world's largest engineering education system. Since 2012, the scale of China's higher education has achieved substantial growth. For example, the gross enrollment rate of higher education has surged from 29.3% in 2012 to 72.0% in 2022, representing an increase of 145.7%;

ISSN: 2710-0170

the number of engineering undergraduate graduates has risen by 31.6%, and the number of engineering doctoral graduates has increased by 23.2%[1]. Teaching models have shown a trend of diversified development. Especially under the development requirements of emerging engineering education, the university-enterprise collaborative education mechanism has been continuously improved, and diversified industry-university-research teaching has been carried out in depth, focusing on strengthening the improvement of comprehensive abilities in the talent training process. Through multi-disciplinary integration, project-driven teaching methods are widely adopted. With the help of overall project plan design and problem-solving, it promotes the construction of innovative thinking and innovative paradigms for high-level talent training. Intelligent teaching is rapidly integrating into the traditional teaching process, deeply combining technologies such as artificial intelligence, machine learning, and neural networks with professional courses to create characteristic cases of engineering optimization[2]. However, the achievement of educational objectives in most engineering courses still needs to be improved: although modern teaching models have been established, their promotion and popularization effects are not satisfactory, and traditional teaching models still dominate the teaching process; the training models of engineering education and academic education tend to be homogenized, with weak engineering practice backgrounds and relatively low proportions of practical credits; knowledge update is seriously lagging behind, showing an obvious disconnect from cutting-edge technologies in the engineering field, especially the knowledge systems related to production intelligent control technology and computer information technology algorithms are too outdated.

3. The Characteristics of University Faculty

Currently, the structure of China's university faculty presents prominent characteristics of multi-dimensional differentiation and dynamic adjustment. The scale of the faculty continues to expand, with distinct stratification in the age structure: research-oriented universities are mainly supported by middle-aged backbone teachers [3,4]; while ordinary universities have a higher proportion of young teachers. Some local universities have over 30% of teachers under the age of 35, resulting in an excessively high proportion of young teachers in their faculty[3,4]. Regional disparities are particularly noticeable. For example, the proportion of young teachers in universities in western China is generally higher than that in eastern China, accompanied by a serious loss of senior professors and a significant phenomenon of talent echelon gap. In terms of competence structure, university teachers generally possess profound research backgrounds and outstanding academic capabilities, demonstrating strong comprehensive strength in basic research. However, most of them lack corporate work experience, with weak engineering practical experience and engineering awareness. Meanwhile, some teachers have not received systematic education and teaching training, and their teaching competence needs to be improved.

4. The Deficiencies of College Teachers in the Teaching of Engineering Courses

4.1. Inadequate engineering awareness, weak engineering-practice experience, and teaching divorced from engineering reality

Specifically, the core contradiction in the teaching of engineering courses is the mismatch between the "academic background" of teachers and the "practical needs" of engineering education [5]. At present, most college teachers are in a current statement "from university to university": they start teaching or research work in universities after graduating with a doctorate, and have an academic-research background. Most of them lack work experience in

ISSN: 2710-0170

the front line of enterprises and have not participated in real engineering projects (such as equipment research and development, process optimization, on-site commissioning). Therefore, they tend to focus on theoretical interpretation in the process of engineering teaching, being good at explaining formula derivation, principle concepts, mechanism quantification, etc., and focus on the theoretical level. However, they cannot disassemble problems in combination with engineering scenarios, or even directly skip engineering-related teaching content. They lack awareness of engineering-based design, component selection, etc., and are even less able to explain the difficulties in equipment and material selection during engineering implementation. As a result, students often face a steep learning curve when adapting to actual operations in enterprises after graduation.

4.2. Inaccurate talent-training positioning

Specifically, inaccurate talent-training positioning stems from multiple factors and constitutes a systematic problem that requires the joint efforts of the government, universities, and enterprises [6]. For college teachers, inaccurate talent-training positioning essentially results from the combined effects of personal career orientation and external support mechanisms, making it difficult for them to accurately align with industrial needs and student-development goals. College teachers, especially young ones, tend to focus on basic research in their scientific work while neglecting practical application. In turn, due to being disconnected from the front line of enterprises, they cannot accurately grasp social demand for talents, and thus struggle to clarify professional positioning and define talent-training goals in the teaching process. On the other hand, due to the lack of a standardized information-sharing mechanism between universities and enterprises, enterprises do not take the initiative to convey the latest job standards to teachers. Teachers also have no convenient channels to obtain industry dynamics, and cannot keep abreast of the latest talent capability requirements driven by enterprise and industry development.

4.3. Lack of teaching experience, traditional teaching methods, and lack of engineering - based teaching design

Young teachers have not received systematic teaching training and lack abilities in teaching - design aspects such as teaching means, teaching methods, teaching process, and teaching content. It is difficult for them to control students' learning needs and psychological needs in the teaching process, and there will be problems such as panic and inability to cope in the teaching process [5,7,8]. At present, although various universities are guiding teachers to carry out multi - means and modern teaching, due to equipment limitations, technical barriers, etc., more than 80% of the courses still mainly use the traditional "lecture - type" teaching method. This teaching method has its advantages, but to a large extent, it is difficult for students to intuitively feel the macro - requirements of engineering and the ability requirements for solving practical problems.

4.4. Incomplete engineering-professional knowledge, and teaching while learning

Specifically, teachers' professional backgrounds do not align with the professional-training direction of talents—this is particularly evident in engineering-oriented courses. Most young teachers have never been exposed to such courses in their studies or work, and have a severe lack of understanding of related equipment. During teaching, they mainly acquire limited engineering-teaching content through textbook learning before conducting actual teaching, making it difficult to expand on teaching content. Due to this lack of practical understanding, they also lack the approaches and ideas to link the knowledge they teach with enterprise production, and the cultivation and improvement of students' engineering thinking are extremely limited. Additionally, there is insufficient investment in necessary practical links for

ISSN: 2710-0170

engineering courses, such as software operation, simulation, and engineering experiments. Some teachers are not proficient in commonly used softwares (e.g., CAD, ANSYS) and only have a superficial understanding. They have to rely on demonstration videos to teach students instead of guiding them through actual operations, which greatly reduces the teaching effect.

4.5. Lagging knowledge update, unable to keep up with industrial-technology iteration

Engineering field technology iterates extremely rapidly. New energy, intelligent manufacturing, artificial intelligence applications and other technologies are changing with each passing day in recent years. However, in sharp contrast, teachers' knowledge system updates at a sluggish pace. Specifically, first, in terms of information channels, college teachers' knowledge update channels are seriously outdated, making it difficult for them to keep up with the pace of enterprise-technology development and update engineering cases in a timely manner. Second, in terms of time allocation, teachers spend most of their time on scientific research. The cost-effectiveness of devoting more time to sorting out and analyzing engineering cases is relatively low, leading teachers to adopt a perfunctory attitude towards updating textbooks and knowledge systems. Additionally, teachers lack interdisciplinary integration capabilities. Given the current social trend of multi-disciplinary cross-integration, most teachers only master single-discipline knowledge, thus being unable to carry out interdisciplinary engineering teaching [6, 9].

4.6. Emphasizing research over teaching, and insufficient teaching investment

Currently, in China's higher education institutions, the assessment and professional title evaluation systems of most universities place heavy emphasis on scientific research, with teaching accounting for a negligible proportion or even being merely an auxiliary requirement. Consequently, this compels teachers to dedicate most of their energy to scientific research in their work, while merely meeting the formal requirements for teaching suffices. Given the extremely low cost-effectiveness of investing in teaching, teachers have no time to investigate industrial needs or update course content. As a result, they can only maintain basic teaching based on traditional textbooks, lesson plans, and teaching methods, resulting in teaching that merely repeats textbook content.

5. Suggestions for Improving Teachers' Literacy in Engineering Courses Teaching

To address the aforementioned issues, the following suggestions are proposed to improve teachers' literacy in engineering course teaching:

First and foremost, from the perspective of university policies, enhance the recognition for teaching work and increase the proportion of teaching work in evaluation systems such as performance assessment and professional title evaluation. This will enable teachers to envision promising prospects in actively promoting teaching-work reform, thereby boosting their enthusiasm and initiative for teaching innovation.

Second, teachers should deeply participate in front-line practical training at relevant enterprises in alignment with the talent-training direction. They need to understand the requirements of production processes, enhance their capabilities in scientific research transformation and engineering practice, and convert practical-training experience and processes into classroom-teaching materials.

Third, improve awareness of scientific-research-achievement transformation and actively carry out related work. On the one hand, this helps teachers develop engineering thinking, grasp the engineering processes and actual needs involved in the transformation of scientific

ISSN: 2710-0170

research achievements, and make engineering course teaching more targeted-effectively integrating textbook knowledge with engineering practice and expanding teaching content. On the other hand, integrating and analyzing the achievement-transformation process can provide usable materials for engineering-course teaching and update the knowledge system.

Fourth, actively update the knowledge system and reconstruct engineering-based teaching methods to enable students to "participate" and immerse themselves in real project-based teaching. Specifically, take actual enterprise projects as the core of courses and decompose the course content into a complete engineering process: "demand analysis → scheme design → software simulation → physical production → acceptance defense" [10,11]. This allows students to truly face problems encountered in engineering applications, analyze the root causes of these problems, discuss and propose improvement plans, and cultivate engineering risk awareness and problem-solving abilities.

References

[1] Wang C, Liang Y, Zhang W. Gloabal Engineering Education Development Index: Current Status, Gaps and Potential of China's Engieering Education. Research in Higher Education of Engineering , 2025,(03):19-27.

[2] Pogue B W, Gladstone D J, Zhang R. Education case report: CAMPEP Medical Physics PhD education program within Engineering. Journal of Applied Clinical Medical Physics,2023, 24(6): e14037.

[3] Bao W, Jin H, Tian M Z. The Relationship between the Age Structure of Faculty and the Research Performance of Research Universities in China. Journal of Higher Education,2020,41(05):54-62.

[4] Qi F, Cai C F. Problems Existing in the Construction of Young Teachers' Team in Colleges and Universities in the New Era and Optimization Paths[J]. University, 2023, (10): 149-152.

[5] Yang Y, Fan Y Y. From Engineering Students to Engineers: The Core Orientation, Practical Dilemmas and Reform Paths of the Engineering Education System[J]. Research in Educational Development, 2024, 44 (19): 78-84.

[6] Chen X M. Practical Dilemmas, Target Orientation and Development Paths of Talent Training in Undergraduate Vocational Education[J]. Journal of Jiangsu Shipping College of Vocational Technology, 2024, 23 (01): 54-57.

[7] Chang Q L, Hu D X, Sun Y H, et al. Integration and Development: The Construction Logic and Practical Paths of the Engineer System[J]. Higher Education Development and Evaluation, 2025, 41(05): 45-55+131.

[8] Martin S, Lopez-Martin E, Moreno-Pulido A, et al. The Future of Educational Technologies for Engineering Education. IEEE Transactions on Learning Technologies. 2021, 14(5): 613-623.

[9] Holly M, Lisa B. Roles of Advances in Engineering Education and Journal of Engineering Education for the engineering education community. Journal of Engineering Education, 2022, 111: 5-8.

[10] Wang H Y, Li C W, Du J, et al. Exploration and Practice of the Construction of Engineering Comprehensive Courses Integrating Theory and Practice—Taking the Course "Intelligent Control Technology for Built Environment" as an Example[J]. Journal of Higher Education, 2025, 11(23): 16-20.

[11] Martin D A, Conlon E, Bowe B. A Multi-level Review of Engineering Ethics Education: Towards a Socio-technical Orientation of Engineering Education for Ethics. Science and Engineering Ethics, 2021, 27, 60.