ISSN 2663-8169 Vol. 8, Issue 1: 13-18, DOI: 10.25236/IJNDE.2026.080103

The Enhancement of Engineering Literacy and Teaching Competence of Young University Teachers from the Perspective of New Emerging Engineering Education

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Abstract: *An optimized design and construction were carried out for the "six-party linkage mechanism of government-school-enterprise-tutor of student evaluation, teacher self-improvement tutor guidance, school, enterprise, and government support which is a long-term mechanism and path for the effective cultivation and improvement of young teachers' professional qualities and teaching abilities in the field of electrical engineering and intelligent control. The implementation effect of the six-party linkage mechanism is discussed, and the achievements of the industrial robot innovation platform and the cooperation base of Harbin University of Science and Technology (electrical engineering and intelligent control major) and Maquart Switch (Weihai) Co., Ltd. are analyzed.*

Keywords: *Engineering Literacy, Teaching Ability, Young Teachers, Higher Education, Emerging Engineering Education*

1. Introduction

To enhance higher education institutions' ability to support economic and social development and meet the demands of rapid growth, the Ministry of Education and other relevant departments have comprehensively launched the "Four New" construction measures. The "Four New" involves "New Engineering, New Agriculture, New Medicine, and New Liberal Arts". Among them, "New Engineering" refers to emerging industries. These are specialized fields targeting emerging industries, such as artificial intelligence, intelligent manufacturing, robotics, and cloud computing. The “Electrical Engineering and Intelligent Control” major of Harbin University of Science and Technology is a newly established major in the emerging industry. It was approved by the Ministry of Education to form enrollment in 2022. However, as the number of young teachers in this major has continued to grow, the proportion has reached 90%. The improvement of young teachers' quality has become a pressing issue in this major, including their personal growth, engineering literacy, teaching ability, and development [1-3]. Improving quality is not only related to the development of young teachers themselves, but also to the quality of personnel training and the development of education in this profession [4-5]. It has become an urgent priority to build a team of innovative and dynamic young teachers.

2. The Necessity of Enhancing the Engineering Literacy and Teaching Ability of Young Teachers

2.1 The Needs of the Rapid Development of China’s Smart Social Economy and Technology

For a long time, the operating mode of local engineering universities in China has been dominated by teaching, with scientific research as a supplement, so there are relatively few conflicts between teaching and scientific research. However, as China's innovative society economy and technology rapidly develop, traditional engineering education focused solely on teaching cannot meet the fundamental needs of the smart society’s economy and technology. Therefore, it is necessary to promote the development of higher engineering education towards a research-oriented model and achieve the integration of science and education.

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2.2 The Needs of the Rapid Development of Higher Engineering Education in China

Young teachers are the leading force in the construction of "New Engineering". Their engineering practice ability and quality directly affect the progress of new engineering construction and the quality of talent cultivation. In other words, the growth and improvement of young teachers are crucial to the healthy development of higher engineering education. Consolidating the team of young teachers and enhancing their abilities has become a necessity for the development of local, application-oriented engineering colleges, and these young teachers also represent a new opportunity for such colleges. It has become an essential means to ensure the quality of undergraduate talent training and serve the local economic construction. Improving the engineering literacy and teaching ability of young teachers has become an urgent need for higher engineering education in China.

2.3 The Urgent Need of Young Teachers: The Inherent Characteristics

Due to the specific nature of college teaching positions in China and the recent increase in requirements for candidates, the academic qualifications of young university teachers have generally improved. Although they have high academic qualifications, most of them lack professional teacher education experience and a weak engineering background. Their teaching experience is not yet perfect; they have heavy teaching tasks, and their ability to guide students' scientific research and practical creativity is insufficient. There is still a significant gap compared to the requirements of high-level local engineering colleges. Therefore, enhancing the engineering literacy and teaching ability of young teachers has become an urgent need for these teachers themselves.

3. The Optimization of the Mechanism and Path for Enhancing the Engineering Literacy and Teaching Ability of Young Teachers

Constructing a scientific and reasonable mechanism, mode, and path to enhance the engineering literacy and teaching ability of young teachers in colleges and universities is the foundation for educational development and the assurance of academic quality. By examining the practices of similar institutions both at home and abroad, this paper optimizes and designs the long-term mechanism and path for the effective cultivation and improvement of young teachers' professional qualities and teaching abilities in the "six-party linkage" mechanism of government-school-enterprise-tutor of student evaluation, teacher self-improvement tutor guidance, school, enterprise, and government support.

3.1 Optimize the Mechanism and Path for Students to Participate in Teaching Evaluation and Supervision

Students' participation in teaching evaluation and supervision of teachers' teaching status are necessary means and approaches for colleges and universities to conduct self-monitoring of teaching quality and for teachers to improve teaching quality. They are also an essential basis for strengthening teaching management and enhancing teaching quality. They are an indispensable part of the teaching quality assurance system in colleges and universities, which plays a vital role in improving teachers' teaching ability and teaching quality. An objective and fair evaluation of teaching quality by students of the instructors (as shown in Table 1) is a basic premise for improving the teaching quality assurance system.

Table 1: Content and Indicators of Student Evaluation Measurement Table

First grade index Q and weighted value	Second index and score values	Excellent (1)	Good (0.8)	Qualified (0.6)	Unqualified (>0.6)
Teaching attitude Q1(0.2)	As a teacher, one should be energetic and passionate, devoting oneself wholeheartedly to every class. (Q1-1)(10) Strong classroom control ability, able to arouse students' interest in this course, and encourage them to study diligently. (Q1-2)(10)				
Teaching content Q2(0.3)	The content is proficient, with key points highlighted, and the explanations of terms, concepts, and viewpoints are clear and accurate; (Q2-1)(20) Spread positive energy and integrate teaching with nurturing people. (Q2-2)(10)				
Teaching methods and means Q3(0.3)	Good at fostering a positive classroom atmosphere, stimulating students' interest in learning, and encouraging active thinking and independent learning. (Q3-1)(15) Emphasize process assessment. Provide timely feedback on assignments, tests, short essays, and experiments. (Q3-2)(5)				

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	Making effective use of AI, the internet, and various teaching resources and methods, the teaching approach is conducive to students' better learning. (Q3-3)(10)				
Teaching effectivenessQ4 (0.2)	Through teaching, enhance students' professional knowledge and perspectives, as well as their practical problem-solving abilities. (Q4-1)(15) Students are delighted with the teaching effect. (Q4-2)(5)				
Overall evaluation Q(1)	Students' comprehensive evaluation of teachers' teaching scores(100)				

3.2 Teachers' independent improvement of engineering literacy and teaching ability, self-improvement mechanism creation, and path exploration

The initiative, enthusiasm, and creativity of teachers in enhancing their professional knowledge and teaching skills have a profound impact on the quality of professional courses. One must be strong to forge iron. If teachers want to handle each teaching condition effectively in the classroom, they must continuously enhance their own qualities and practical engineering skills.

3.2.1 Establish a correct outlook on life, values, and worldviews.

The first step in enhancing one's own academic literacy, teaching ability, and engineering practical ability is for young teachers first to establish a correct outlook on life, values, and worldviews. One way for young teachers to enhance their own qualities is through extensive reading, studying history, and becoming familiar with traditional Chinese culture. The truth accumulated through the baptism of history contains the correct outlook on life, values, and world outlook of human beings. After receiving training, young teachers incorporate course-based ideological and political education into each class, aiming to cultivate students' correct values.

3.2.2 The improvement of teachers' professional knowledge and teaching ability

The knowledge structure and teaching ability of young teachers are acquired through continuous cognition, experience, accumulation, and sublimation in teaching practice. Only through persistent effort can they enrich their teaching theory, refine their teaching practice, and continually reconstruct their knowledge structure to achieve continuous professional development and enhanced teaching ability.

3.2.3 Stay up to date and closely follow the latest developments and trends in this discipline.

In addition, the random change of external conditions, the change of teaching environment and the innovation of teaching facilities all make the professional development of young teachers must combine the frontier and practice of education and teaching, pay attention to and keep up with the frontier development and dynamics of the subject in real time, keep up with the pace of the times, take the initiative to cooperate effectively with industry technicians, experts, scholars, teachers, students and other groups, adopt the win-win cooperation promotion mode, exercise their ability to analyze, refine and solve problems, so that young teachers can continuously improve their professional knowledge, engineering practice and teaching ability.

3.3 Establishment of the tutorship system for young teachers and attempts to explore practical approaches

By adopting the tutorial system training mode, it is possible to cultivate teaching talents who meet the requirements of different positions more efficiently and specifically.

3.3.1 Tutor of choice

Tutors should possess good political literacy and moral character, have high teaching ability and engineering literacy, and be familiar with the basic requirements and fundamental laws of teaching work. When selecting tutors, the following qualifications should be comprehensively considered: having taught for a certain number of years; holding the title of associate professor or above; having demonstrated excellent teaching quality in recent years; and having strong scientific research ability, with teaching and research rewarded. The tutor should also have qualities such as optimism and positivity, respect and understanding for others, a willingness to share, active listening, and strong communication skills.

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3.3.2 The cultivation path of teaching ability

Teaching business knowledge. Tutors can cultivate young teachers' interest and pursuit in educational work by exchanging their teaching career experience and professional growth processes; Sharing the love and dedication to teaching work, gradually establishing the sense of identity and honor of young teachers to higher education work, and enhancing the consciousness of loving and dedicating to education work. Guiding young teachers to study industry laws and regulations, such as the *Teacher Law, Psychology, Educational Psychology, Pedagogy, and Comprehensive Quality of Teachers*, as well as professional books, to understand their own norms and requirements for teaching and encouraging young teachers to use platforms such as AI, the Internet, and We Chat official accounts to stay up to date with the latest developments in higher education and the industry, and to absorb and update relevant professional knowledge.

3.3.3 The cultivation path of engineering literacy

Subject knowledge reserve. Mentors should guide young teachers to master solid subject professional knowledge, understand educational policies and guidelines, and academic trends, be familiar with the new curriculum standards for the subject, learn subject teaching materials, and build comprehensive subject knowledge reserves for deep participation in teaching. In the process of communication and guidance, tutors should help young teachers realize that they should develop career plans from the beginning of their teaching positions, delve deeply into their disciplines and specialties, and become learning- and scholar-oriented teachers.

Engineering literacy improvement. Tutors should guide young teachers to participate in various levels of scientific research experimental projects in the laboratory and to personally operate various experimental instruments and equipment, so that they become proficient in the working principles and structures of these instruments and equipment, and possess the ability to maintain and repair them. In-depth analysis of experimental results and data; write the experimental analysis report; identify shortcomings; and provide improvement suggestions, thereby enhancing the engineering literacy of young teachers.

3.4 The mechanism and path for schools to assist young teachers in enhancing their engineering literacy and teaching ability

3.4.1 Mechanisms and paths for teaching ability training

Adhere to a flexible and diverse training mechanism that is tailored to individual needs, both online and offline, with on-campus and domestic on-the-job training as the primary focus and off-campus and overseas full-time training as supplementary. The school regularly or irregularly offers targeted training courses on teaching ability for professional teachers, both within and outside the school. It encourages and supports young teachers to participate in various professional development courses and academic conferences organized by the Ministry of Education, industry associations (societies), provincial education departments, and other institutions.

3.4.2 Mechanisms and paths for enhancing engineering literacy

Actively support, organize, and assist young teachers to participate in industry and enterprise production practice, to gain an in-depth understanding and mastery of the product design, manufacturing process, production operation process, and process equipment involved in this major. Encourage and support young teachers to participate in international, national, and provincial skills competitions; guide students' innovation competitions; and obtain professional skill qualification certificates at all levels at home and abroad, thereby enhancing young teachers' professional skills.

3.4.3 Set up special funds to support young teachers' teaching reform and scientific research exploration

The school establishes special funds and, according to a predetermined proportion, selects outstanding young teachers each year. It provides this part of young teachers with support from funds and encourages them to be courageous, boldly create, and carry on the past while opening the future. Support and trust young teachers as they undertake essential core professional courses and other teaching tasks in their fields. The school Supports young teachers in undertaking national, provincial, and ministerial-level scientific research and teaching reform projects, and provide them with convenience in terms of funds, materials, personnel, experimental venues, and time.

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3.5 Establishment of national large enterprises and a project support mechanism

Cultivating young teachers should give full play to the central role of undergraduate colleges and universities and large state-owned enterprises, establish a "school-enterprise production-study-research-application" co-construction platform, and establish a win-win mechanism. In line with the requirements of "production position→enterprise role→engineering project→student training quality", young teachers are encouraged to participate in enterprise engineering project research actively. Young teachers practiced in depth and personal experience of the entire process of enterprise engineering project research, and the professional engineering practice knowledge and skills involved, and the solidly cultivate the engineering skills.

3.6 The necessary government policies and funding support mechanisms

As the policy-makers, the government should play a leading role. It should consider the perspectives of various entities, establish relevant laws and regulations, management systems, and supervision mechanisms, promote effective interaction and integrated development among local colleges and universities, enterprises, individual teachers, etc., and provide financial support.

4. The Effect of Teaching Reform

Based on the reform and practice of this project, the teaching and engineering environment, as well as the training platform for young teachers in this major, have been established. The training of young teachers' teaching ability, engineering thinking, literacy, and creative ability is emphasized to enhance their engineering literacy and teaching ability significantly, and to meet the needs of undergraduate teaching in this major. The school and enterprises jointly establish an "industry-university -research-application" platform. Relevant enterprises actively participated, and a multi-party platform for teaching and sharing engineering skills was built to ensure the regular operation of the training mechanism for young teachers. For instance, the newly established platform integrates industrial robot technology, modern control theory, and automatic control principles and techniques to build an intelligent, advanced, and efficient platform for industrial robot design and technology research.

In June 2025, Harbin University of Science and Technology (Electrical Engineering and Intelligent Control Major) -Maquart Switch (Weihai) Co., Ltd. established a cooperation base for industry, university, and research. Figure 1 is the unveiling ceremony of industry-university-research-application cooperation.

(a) School-enterprise cooperation and exchange *(b) Industry-university-research-application cooperation unveiling ceremony*

Figure 1. The unveiling ceremony of the industry-university-research-application cooperation base of Harbin University of Science and Technology - Marquardt Switch (Weihai) Co., Ltd

5. Conclusion

Through this project's reform to cultivate young teachers' capabilities, we have innovatively established a "six-party linkage" mechanism of government-school-enterprise-tutor for teacher training, integrating the improvement and cultivation of young teachers' abilities across the whole system, thereby enhancing their engineering literacy and teaching abilities. It is emphasized that young teachers should continually explore, consolidate professional knowledge, strengthen practical skills, and

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improve their professional competence to better adapt to their current work positions and have sustainable development potential.

Acknowledgments

This work has been supported by 2023 Higher Education Research Project of Heilongjiang Association of Higher Education (Project Number: 23GJYBF029).

References

[1] Xinheng Li, Xiaojie Zhou. Exploration and Practice of Transformation and Upgrading of Electrical Engineering and Automation Specialty from the Perspective of Emerging Engineering Education. Shaanxi Education (Higher Education), 2025(04): 41-43.

[2] Jinling Zhang, Yitong Liu, Hongwen Yang. Practice of an Educational Model to Strengthen Theoretical Foundation and Improve Engineering Literacy. Teaching Forum, 2025(42): 161-164.

[3] Guangming Wang. Research on Core Literacy and Capacity Building for Teachers. Science Press, September 1, 2023.

[4] Ruiying Shao, Hongjun Wang, Juan Song. Research on Engineering Literacy of Engineering Faculty in Universities under the Background of Emerging Engineering Education. Naval Vocational Education, 2023, 11(01): 71-73.

[5] Shigang Mou. Implementation Strategies for Cultivating Engineering Competence of Faculty in Engineering Universities. Teaching Forum, 2019(35): 29-30.