Journal of Contemporary Educational Research, 2025, Volume 9, Issue 5
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Focusing on Interdisciplinary Application Abilities: "Promoting Research through Courses" as a New Path for Cultivating Professional Degree Postgraduates

Hongda Liu*, Gui Xiao, Yidong Xu, Qi Yan, Desheng Fan, Chongyang Xu

Yantai Research Institute, Harbin Engineering University, Yantai 264000, Shandong, China

***Corresponding author:** Hongda Liu, liuhd405@hrbeu.edu.cn

Abstract: Currently, talent cultivation faces numerous challenges, such as a shortage of school-enterprise tutors and a disconnection between curriculum construction and industry demands. The "promoting research through courses" model has emerged in response to these challenges. Its goals include training students' research capabilities, cultivating their interdisciplinary learning and application abilities, and establishing an ecological closed loop between education and research. The reform measures involve innovating curriculum design to create new, advanced, and practical courses, adopting a hierarchical and progressive classroom teaching method combined with post-class diversion guidance, and conducting online-offline integrated case-based and scenario-based teaching. The reform has achieved remarkable results. Students have enhanced their research abilities, knowledge application, and professional qualities. Schools have strengthened their discipline construction, teaching staff, and social influence. Enterprises have realized their talent reserves and technological innovations. The teaching model has integrated theory and practice, promoting the high-quality development of education and teaching, and providing a new path to solve the problems in education and industry development.

Keywords: Promoting research through courses; Interdisciplinary and applied talents; Curriculum reform

Online publication: May 28, 2025

1. Introduction

The "Professional Degree Postgraduate Education Development Plan (2020–2025)," jointly issued by the Academic Degrees Committee of the State Council and the Ministry of Education, requires improving the ability level of professional degree postgraduates. Interdisciplinary integration is conducive to realizing interdisciplinary knowledge exchange and innovation, aligning with national strategies, promoting the cultivation of new engineering talents, and facilitating education reform and industrial upgrading [1]. To meet the needs of the social economy and enterprise development for creative applied talents [2], it is necessary to

strive to promote talent cultivation reform. This requires constructing a collaborative education system, opening up school-enterprise cooperation education channels, and cultivating a collaborative classroom culture [3], thus enhancing the quality of education. However, exploring implementation methods and breakthrough points that can improve the quality of postgraduate training, achieve efficient interdisciplinary education, and are operable for most universities remains a challenging task. Currently, there are still some deficiencies in the reform and exploration of applied talent cultivation [4].

The innovation of professional degree postgraduate training cannot be achieved without high-level tutors. However, currently, there are problems among school-enterprise tutors, such as emphasizing theory over practice, a lack of communication, and having insufficient quantity and quality. In this situation, leveraging the advantages of multiple teachers and resources to build high-level signature courses and promote them is a viable talent cultivation path.

At present, China's postgraduate education cannot fully meet the diverse needs of economic and social development, and postgraduate-stage learning has not significantly contributed to students' subsequent career development [5]. "Strengthening curriculum construction, emphasizing the role of curriculum teaching in postgraduate training, and strengthening the training of postgraduates' scientific methods and academic qualities through high-quality curriculum learning" [6] has become an important measure to improve the quality of postgraduate training. However, it remains a difficult problem in teaching practice to carry out effective curriculum construction based on China's actual situation [7]. In the context of the integration of industry and education, the curriculum structure of universities needs to be adjusted. It should be combined with industry demands, and universities should jointly design curriculum content with enterprises, increase practical courses, and innovate curriculum content to achieve the unity of knowledge and ability [8].

The emergence of "promoting research through courses" brings hope for solving the problems in postgraduate curriculum construction. It combines courses with scientific research and is expected to break the deadlock in school-enterprise cooperation and promote the integration of industry and education. This article will explore its connotation, implementation path, and effectiveness, providing a reference for the development of education and industry.

2. The goal orientation of the "promoting research through courses" reform

2.1. Training research abilities

"Promoting research through courses" focuses on the comprehensive cultivation of students' research abilities and plays a crucial role in teaching practice. The curriculum is designed around the actual needs of enterprises and cutting-edge industry technologies. By introducing real-world enterprise project cases, students are exposed to industry challenges. For example, in the Energy Internet and Smart Grid Technology course, a postgraduate course that teaches about the current development status, challenges, technological trends, and countermeasures of the power energy system, which is the hub for achieving the "dual-carbon" goal, is based on the integration of multiple disciplines such as electrical engineering, control engineering, energy and power, electronic information, meteorology, and management, as well as the integration of universities and enterprises, and theory and practice, as shown in **Figure 1**.

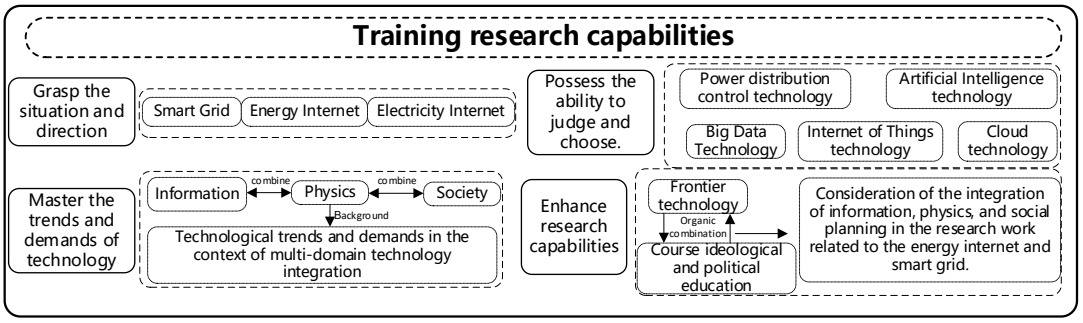

Figure 1. Training research ability with the Energy Internet and Smart Grid Technology course as an example

In the process of curriculum learning, students are no longer limited to mastering theoretical knowledge. Instead, they are project-oriented and go through a complete scientific research process from problem-raising, solution-design, and technology-selection to practice-verification. Under the joint guidance of teachers and enterprise mentors, students learn to use professional knowledge to analyze project requirements, select and apply appropriate cutting-edge technologies to solve practical problems, and exercise scientific research skills such as literature research, experimental design, and data analysis.

2.2. Cultivating interdisciplinary learning and application abilities

In the "promoting research through courses" model, universities and enterprises collaborate to develop teaching content aligned with curriculum goals, integrating real enterprise projects and technical requirements into the curriculum. This model dismantles the information barrier between schools and enterprises. Enterprise mentors actively participate in curriculum instruction, working alongside university educators to guide students.

The two sides regularly exchange information during teaching and research, sharing the latest industry trends, technical challenges, and academic research findings. By participating in project-chain-based teaching, students progressively acquire the applied skills necessary for interdisciplinary knowledge, spanning project conception, design, and implementation. In cooperative inquiry-based learning, students from diverse disciplinary backgrounds interact with one another, generating new ideas and expanding their problem-solving perspectives. Converting multi-disciplinary knowledge into practical outcomes not only enhances students' abilities to learn and apply interdisciplinary skills but also fosters their innovative and practical competencies.

2.3. Establishing an ecological closed loop of "education feeding back into research and research upgrading education"

Under the "promoting research through courses" model, students apply the theoretical knowledge learned in class to actual enterprise research and development projects. By solving technical problems in the R&D process, students not only deepen their understanding of professional knowledge but also enhance their scientific research and practical skills, creating valuable feedback from education to research.

New challenges and demands arising from enterprise R&D processes offer rich and cutting-edge cases and research topics for curriculum instruction. Universities can then update teaching content and optimize the curriculum system based on these, allowing education to keep pace with industry technological development trends and achieve the advancement of teaching through research.

3. The reform measures of "promoting research through courses"

3.1. Curriculum design

In the curriculum design of "promoting research through courses," a unique and forward-looking concept is adhered to. On the one hand, efforts are made to clearly present a complete set of methodologies and knowledge "technology trees" to students. In terms of curriculum content selection, it closely follows the trend of the times, integrating emerging advanced technologies such as artificial intelligence, big data analysis, and blockchain applications, and introducing advanced industry routes and cutting-edge concepts, enabling students to access the most advanced knowledge systems and keep abreast of industry trends. In the teaching implementation process, great importance is attached to the all-around cultivation of students' professional abilities, professional qualities, and professional thinking.

The curriculum design also focuses on creating remarkable features of "newness," "advancement," and "practicality." "Newness" is reflected in the up-to-date curriculum content and teaching methods, constantly updating the knowledge system and using new teaching means such as online-offline hybrid teaching and virtual simulation teaching. "Advancement" emphasizes that the teaching process is always guided by advanced technology trends, ensuring that university teaching is closely aligned with enterprise demands. "Practicality" is realized through the emphasis on practical teaching. Students can accumulate rich practical experience through enterprise internships and participation in actual projects, truly applying what they have learned and laying a solid foundation for future career development. The curriculum design concept is shown in **Figure 2**.

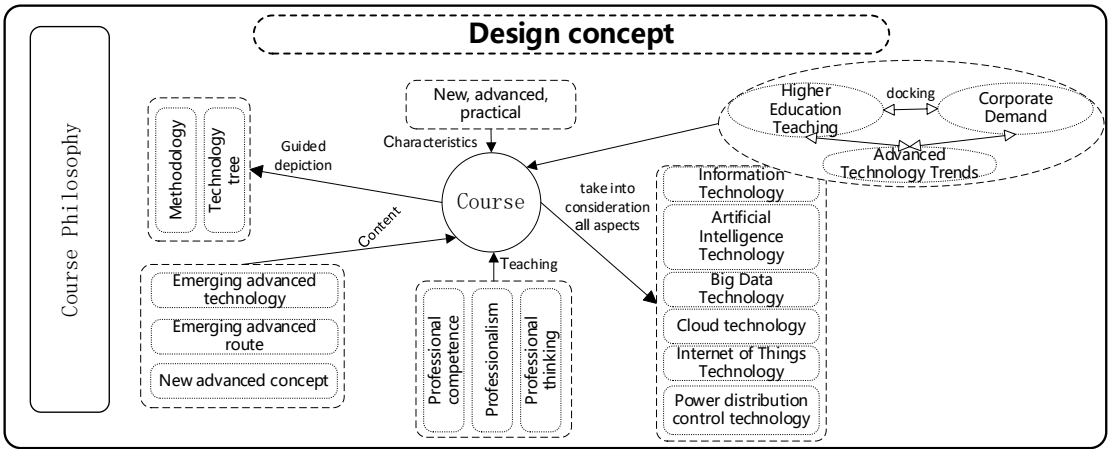

Figure 2. Course content and teaching method design

3.2. Hierarchical setup and progressive classroom teaching + post-class specialized diversion guidance

During the classroom teaching stage, by leveraging the advantages of multiple teachers (university professors, enterprise technical experts, and industry specialists) and multiple resources, a hierarchical setup and progressive teaching framework are constructed. University professors impart professional theories, enterprise technical experts share practical cases, and industry specialists introduce cutting-edge trends. The curriculum content is designed with gradually deepening knowledge points and problem situations according to teaching goals and students' cognitive levels.

After class, specialized diversion guidance is carried out. According to students' interests, professional foundations, and career plans, students are divided into different specialized groups, and a guidance team composed of university teachers and enterprise mentors provides targeted guidance. For students interested

in academic research, teachers guide them to explore theoretical issues in the curriculum, conduct academic research, and write academic papers. For students inclined to practical applications, enterprise mentors lead them to participate in actual enterprise projects for technology development and operation.

3.3. Online-offline integrated case-based and scenario-based teaching

Representative real-world engineering/scientific research cases covering different scales, technical difficulties, and application fields are collected and screened. Based on the content of these cases, scenario-based teaching situations are constructed. Through multimedia demonstrations, field visits, and project simulations, students can experience the actual operation of engineering/scientific research projects.

Taking the Energy Internet and Smart Grid Technology course as an example, enterprise experts and industry experts teach students real-world engineering/scientific research cases. The teaching process integrates curriculum-based ideological and political education, enabling students to understand the hard work and build the world's largest-scale power grid. This enhances students' sense of reality, encourages them to face real problems, guides them to solve bottleneck problems, and thus, inspires their patriotism. During the teaching process, online and offline interactions are carried out through on-site or remote access to enterprise project cloud platforms and the software and hardware resources of school-enterprise joint laboratories.

4. The reform achievements of "promoting research through courses"

4.1. From the student's perspective

The "promoting research through courses" reform benefits students the most. In terms of research capabilities, students learn to independently discover, analyze, and solve complex problems through participating in actual projects and scientific research processes in courses. Through project participation, students develop the ability to independently face industry technical challenges. Their knowledge application ability is also significantly enhanced, and the theoretical knowledge they have learned can be flexibly applied in practical scenarios. At the same time, project participation enriches students' resumes, which is of great help for future employment.

In addition, students' professional qualities are comprehensively cultivated. Participating in enterprise projects and team collaborations enables students to understand the importance of teamwork and communication, respect others' opinions, give full play to their respective advantages, and improve work efficiency. Facing project challenges, students gradually develop perseverance and an innovative spirit, actively exploring new methods and ideas.

4.2. From the school's perspective

Schools have achieved fruitful results in the "promoting research through courses" reform. In terms of discipline construction, through in-depth cooperation with enterprises, schools can promptly understand the latest industry technologies and demands, integrate them into the curriculum system and scientific research projects, and promote the renewal and innovation of discipline knowledge. For example, the Energy Internet and Smart Grid Technology major integrates the industry's "dual-carbon" goal requirements and opens up relevant cutting-edge research directions, enabling discipline development to keep up with the pace of the times.

4.3. From the enterprise's perspective

Enterprises have also obtained tangible benefits from the "promoting research through courses" reform. In terms of talent reserve, enterprises can contact and screen outstanding students in advance through participating

in curriculum teaching and project guidance, achieving precise talent cultivation and reserve. Enterprise mentors can deeply understand students' professional abilities and comprehensive qualities during the guidance process, facilitating the selection of suitable talents for enterprises.

4.4. From the teaching model's perspective

"Promoting research through courses" has promoted the innovation and development of teaching models. Traditional teaching models focus on theoretical knowledge imparting, while "promoting research through courses" realizes the in-depth integration of theory and practice. Multiple teaching models complement and develop synergistically, forming a diversified teaching model system, providing useful references for education and teaching reform, and promoting the high-quality development of education and teaching.

5. Retrospect and prospects

In the context of the integration of industry and education, "promoting research through courses" provides an innovative solution to the problems in professional degree postgraduate education. Aiming to train research capabilities, cultivate interdisciplinary learning and application abilities, and build an ecological closed loop of education and research, it has achieved remarkable results through measures such as curriculum design, hierarchical teaching with diversion guidance, and online-offline case-based teaching. Students' abilities and qualities have been enhanced, schools' discipline construction and teaching staff have been strengthened, enterprises have achieved talent reserve and technological innovation, and the teaching model has witnessed innovative development.

In the future, it is necessary to further promote the "promoting research through courses" model, continuously improve reform measures, and deepen the integration of industry and education. This will strongly support the cultivation of high-quality professional degree postgraduates who can adapt to economic and social development and promote the coordinated development of education and industry.

Funding

This project was jointly funded by the Teaching Reform Project of Heilongjiang Province, China, titled "Research and Quantitative Analysis of the 'Three Integrations + Double Traction' Cultivation Model for Professional Degree Master Students" (SJGY20210190), the Key Teaching Reform Project of Shandong Province, China, titled "Research on the Cultivation Model of the Integration of Industry and Education for Engineering Professional Degree Postgraduates under the Background of 'Marine Engineering Complex'" (SDYJG21053), and the Postgraduate Teaching Reform Project of Harbin Engineering University, titled "Research on Key Core Issues of Scientific Research Practice for Professional Master Students——Taking the Electronic Information Major of Yantai Institute as an Example" (JG2021Y074).

Disclosure statement

The authors declare no conflict of interest.

References

[1] Jiang Z, 2018, Strategic Positioning and Development Path of Talent Cultivation in Colleges and Universities in the New Era—Interpretation Based on the "Opinions on Deepening the Reform of the Education System and Mechanism." Chongqing Higher Education Research, 2018(1): 3–11.

[2] He Z, Chen L, Zhu L, 2023, A Study of Inter-Technology Information Management (ITIM) System for Industry-Education integration. Heliyon, 9(9): e19928.

[3] Bao Z, Zhang X, 2023, The Construction of Shared Wisdom Teaching Practice through IoT Based on the Perspective of Industry-Education Integration. Wireless Communications and Mobile Computing, 2023(1): 7298400.

[4] Yang Q, Zhan X, Hua H, 2025, Exploration and Practice of Cultivating New Engineering Applied Talents with "Dual Subjects, Three Integrations, and Four Interlinks"—Taking the Automation Major in Local Universities as an Example. Journal of Hubei Normal University (Natural Science Edition), 45(01): 115–118.

[5] Yu Y, Liu X, 2024, Discipline Construction in Universities Oriented by Industrial Demands and Its Path Optimization. Academic Degrees & Graduate Education, 2024(2): 63–70.

[6] Ministry of Education, National Development and Reform Commission, Ministry of Finance, 2013, Opinions on Deepening the Reform of Postgraduate Education: No.1 of Teaching and Research, viewed September 10, 2022, http://www.moe.gov.cn/srcsite/A22/s7065/201304/t20130419_154118.html

[7] Li F, Zhou J, 2024, Promote the Construction of a Strong Country in Graduate Education and Accelerate the Cultivation of Top-Notch Innovative Talents. Research in Graduate Education, 2024(1): 1–7.

[8] Liu Q, 2025, Deepen the Integration of Industry and Education to Cultivate High-Level Applied Talents, Ningxia Daily, March 28, 2025, (007).