

Research on the Training of Innovation and Entrepreneurship Education for High-Level, Applied and Innovative Professional Degree Postgraduates

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Abstract: With the continuous advancement of the country's construction of "new engineering disciplines" and the reform of professional degree graduate education, innovation and entrepreneurship education has become an important way to improve the quality of graduate training. Based on the survey data from the School of Mathematics and Physics, this paper systematically analyzes the main problems existing in the innovation and entrepreneurship education for professional degree postgraduates through questionnaires, interviews and other methods, including insufficient atmosphere, imperfect system, lack of willingness and ability, incomplete educational layout, and shortage of teachers and practice platforms. On this basis, it proposes a collaborative education model centered on the integration of "industry, teaching, research and application," and puts forward specific countermeasures from the aspects of policy guidance, tutor team construction, integration of school-enterprise resources, and optimization of curriculum and teacher systems, so as to promote the all-round improvement of the innovation and entrepreneurship ability of professional degree postgraduates.

Keywords: Professional degree postgraduates; Innovation and entrepreneurship education; Industry-education integration; Dual-tutor system; Curriculum system

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1. Research background

With the in-depth implementation of the innovation-driven development strategy, the country's demand for high-level applied and innovative talents has never been greater. The construction of "new engineering disciplines" is a strategic initiative implemented by China to proactively respond to the new round of scientific and technological revolution and industrial transformation. It advocates reforming learning methods and

teaching models to cultivate high-quality applied talents to meet the fundamental needs of modern industrial development ^[1]. In September 2020, the Academic Degrees Committee of the State Council and the Ministry of Education jointly issued the Development Plan for Professional Degree Graduate Education (2020-2025), which clearly proposed to deepen the reform of the industry-education integration training model and fully integrate innovation and entrepreneurship education into the talent training system ^[2]. This puts forward new requirements and points out a new direction for promoting the high-quality development of professional degree graduate education.

However, at present, universities, especially science and engineering departments, generally face practical dilemmas in carrying out innovation and entrepreneurship education for professional degree postgraduates, such as the disconnection between the training system and industrial needs, the shortage of practice platforms, and the insufficient innovation motivation of students. Therefore, against this major policy background, focusing on the energy and electric power field, systematically exploring the current situation, problems and optimization paths of innovation and entrepreneurship education training for professional degree postgraduates is of important theoretical significance and practical value for implementing national strategies, promoting the reform of university talent training, and serving the innovative development of industries.

2. Basic information of the survey respondents

This survey targeted professional degree graduate students of the School of Mathematics and Physics, using self-designed questionnaires and interviews. The School currently has 37 supervisors, categorized as follows: 14 (37.84%) from the Department of Mathematics and 23 (62.16%) from the Department of Physics; 9 (24.32%) professors, 25 (67.57%) associate professors, and 3 (8.11%) lecturers. There are 241 professional degree graduate students, including 71 (29.46%) from the 2022 cohort, 78 (32.37%) from the 2023 cohort, and 92 (38.17%) from the 2024 cohort; among them, 99 (41.08%) are majoring in Big Data Technology and Engineering, and 142 (58.92%) in Clean Energy Technology.

3. Problems identified in the survey

3.1. Insufficiently robust innovation and entrepreneurship atmosphere

In recent years, the scale of graduate students has grown rapidly, but the graduate training system remains inadequate, the development of the supervisor team needs to be strengthened, and the quality of dissertations needs further improvement. Efforts are required to enhance the construction of academic degree programs, strengthen the process management of graduate students, and improve the formulation and refinement of various rules and regulations. It is necessary to reasonably develop training programs for each major, clarify the training objective of cultivating professional talents with characteristics in energy and electric power, and optimize the allocation of enrollment quotas for master's supervisors in the school to improve the quality of talent cultivation.

Currently, there are significant differences in the methods and intensity of innovation and entrepreneurship education implemented. The promotion of policies and the importance of such education are insufficient, failing to foster a strong atmosphere for innovation and entrepreneurship. The integration and systematicness between innovation and entrepreneurship courses and professional education courses are inadequate. The courses outlined in the talent training programs lack completeness, systematicness, and innovative teaching strategies,

and have little connection with professional disciplines. As a result, graduate students struggle to acquire innovative thinking and entrepreneurial capabilities through systematic learning, which fails to stimulate their enthusiasm for exploration.

3.2. Inadequate graduate training system

Producing high-level outcomes in master's graduate training requires long-term accumulation, especially for professional degree graduate students. Flexible and diversified graduation assessment methods could be explored to both supervise graduate students' research efforts and support supervisors' research projects, while encouraging supervisors to secure horizontal projects. For the majors of Clean Energy Technology and Big Data Technology and Engineering, a classified assessment should be considered.

To strengthen industry-university-research cooperation, it is necessary to expand off-campus practice and joint training bases for graduate students to create more practical training opportunities. Graduate student workstations are important platforms for industry-university-research cooperation: they enable graduate students to refine research topics to help enterprises solve problems and develop new products, while enterprises provide the necessary conditions for graduate students. As a key approach to cultivating high-level applied research talents, industry-university-research cooperation should be used as a starting point to promote university-enterprise collaboration.

3.3. Weak willingness and insufficient capacity for innovation and entrepreneurship

Postgraduates have limited energy, time, and enthusiasm to participate in innovation and entrepreneurship activities due to heavy academic pressure. Additionally, the training of professional master's students in colleges focuses on professional knowledge and skills, while there is a lack of education on innovation and entrepreneurship knowledge, market information resources, and supportive training. This results in a weak foundation for postgraduates' quality and capabilities in innovation and entrepreneurship.

3.4. Incomplete layout of innovation and entrepreneurship education

Currently, the innovation and entrepreneurship education for postgraduates has not established a systematic framework. Courses are mainly offered as electives, leading to fragmented knowledge foundations. Moreover, these courses are not integrated with majors, failing to leverage professional advantages. The talent training curriculum system fails to meet actual needs, as teaching emphasizes theory over practice and is disconnected from real-world scenarios.

3.5. Limited competence of relevant faculty and shortage of practical platforms

The training of professional degree postgraduates should organically integrate in-class learning with career development ^[3]. At present, most full-time teachers in colleges have no entrepreneurial experience, and their teaching lacks interdisciplinary research and practical operability, which cannot help postgraduates develop innovative and entrepreneurial thinking. Supervisors focus their energy on academic guidance, and due to the lack of incentive mechanisms, their role in innovation and entrepreneurship education has not been fully exerted. Meanwhile, there are few practical platforms for postgraduates' innovation and entrepreneurship, the role of the "second classroom" has not been fully played, and postgraduates have few opportunities to practice and accumulate experience.

4. Rectification paths and measures

The reform of innovation and entrepreneurship education is currently a breakthrough for advancing the comprehensive reform of higher education ^[4]. In response to the common problems faced in cultivating the innovation and entrepreneurship capabilities of professional degree postgraduates under the background of new engineering construction, this paper analyzes the dilemmas in improving their innovation and entrepreneurship capabilities, and proposes an innovative talent cultivation model based on the “industry-university-research-application” four-in-one collaborative education. It designs a cultivation path oriented by market demand and targeted at innovation and entrepreneurship capabilities. It is intended to enhance the professional ethics, innovation and entrepreneurship awareness, and professional practical capabilities of professional degree postgraduates by “reconstructing an interdisciplinary professional curriculum system, building a project-driven innovative practice platform, and developing an ‘industry-university-research-application’ integrated collaborative education approach.”

4.1. Guided by top-level design

Colleges should develop sound top-level design for graduate innovation and entrepreneurship education, with the cultivation of innovative talents as the fundamental goal. Efforts should be made to build an education system, foster a supportive atmosphere, and explore new models. Foreign universities have rich experience in innovation and entrepreneurship education. For example, American universities adopt a cluster model, establishing dedicated centers, implementing student-centered teaching, and securing funding support ^[5]. This indicates that systematic organizational support and resource matching are crucial.

To improve the quality and efficiency of graduate innovation and entrepreneurship education, colleges can adopt an open training approach of “going out and bringing in”. They should support full-time teachers to “go out” for temporary positions and practical experience to enhance their capabilities; promote university-enterprise cooperation to facilitate achievement transformation and demand matching. Meanwhile, outstanding entrepreneurs and other professionals should be “brought in” as mentors or teachers to share cutting-edge trends and practical experience. Through the reconstruction of the education system, graduate participation can be enhanced, encouraging them to engage in innovative practice and entrepreneurial activities.

4.2. Supported by tutor teams

Colleges should advance the “dual-tutor system,” mobilize the enthusiasm of on-campus tutors, and build high-quality tutor teams. Off-campus tutors, who master cutting-edge technologies, understand industrial needs, and have practical experience, can provide valuable guidance to graduates. Colleges should leverage the advantages of off-campus tutors to help graduates with career planning, strengthen team communication, and provide professional support. When cultivating graduates, tutor teams should not only focus on developing their independent research capabilities but also integrate innovation and entrepreneurship concepts into daily teaching, encouraging graduates to participate in related activities to enhance their comprehensive abilities.

4.3. Leveraging on-campus and off-campus resources

Practical on-the-job skills play a decisive role in consolidating theoretical knowledge, so attention should be paid to the matching of professional skills. The cultivation of professional degree graduates is faced with problems such as an excessive “academic orientation” and the weakening of “professional” and “practical”

characteristics^[6]. In addition to establishing a sound platform for graduate innovation and entrepreneurship practice, colleges can also utilize on-campus research platforms and resources, take enterprise needs as the driving force, and rely on university-enterprise joint training bases and graduate workstations to jointly carry out project research and talent cultivation, realizing the sharing of university-enterprise resources. Graduates should be encouraged to participate in university-enterprise cooperation projects and R&D activities, so that they can understand the market and industry status quo, solve problems with new methods and technologies, increase opportunities for communication with enterprise professionals, and gain innovation and entrepreneurship experience.

Furthermore, colleges should use competitions, projects, and associations to stimulate graduates' enthusiasm for innovation and entrepreneurship. For training programs related to innovative practice competitions, enterprise experts can be invited for guidance; these experts can also serve as judges for academic competitions. The innovation and applicability of entries are key evaluation indicators, and enterprises focus on technological innovation as well as social and economic benefits in their evaluation. Therefore, it is necessary to establish a linkage mechanism by leveraging the resources of university-enterprise industry-academia-research cooperation.

4.4. Strengthening the construction of the graduate innovation and entrepreneurship curriculum system and faculty team

Full consideration should be given to the individual differences of professional degree graduates. Evaluation should not only be based on academic performance and research achievements, but also attach greater importance to the assessment of their practical abilities^[7]. Some domestic universities have actively explored curriculum design. For example, Zhejiang University offered more than 150 innovation and entrepreneurship courses in 2017 and promoted the construction of a three-level progressive curriculum system^[8].

Colleges should formulate scientific training programs. Graduate innovation and entrepreneurship education often neglects the imparting of humanistic knowledge and spirit, so universities need to integrate humanistic literacy cultivation into education^[9]. The training program for professional master's students should include no less than six months of professional practice, relying on enterprise engineering practice projects to improve their practical engineering capabilities and enhance their competitiveness. At the same time, university-enterprise cooperation courses can be set up, and enterprise experts can be invited to teach part-time and guide graduate students in innovation and entrepreneurship practice.

A high-quality faculty team for innovation and entrepreneurship education is a necessary condition for cultivating innovative and entrepreneurial talents. At present, most innovation and entrepreneurship courses are taught by counselors who have strong theoretical knowledge but lack practical experience, resulting in insufficient teaching attractiveness and integration^[10]. Therefore, colleges should build excellent teaching teams: train non-professional teachers to enrich their theoretical knowledge, and hire external professionals, enterprise mentors, experienced personnel, and alumni to join the faculty team to jointly complete teaching and guide graduate students in practical projects^[11].

5. Conclusion

Based on the actual investigation of innovation and entrepreneurship education for professional degree

graduates, this study systematically analyzes the main problems existing in the current training process, including insufficient innovation and entrepreneurship atmosphere, imperfect training system, inadequate students' willingness and abilities, incomplete educational layout, and shortage of faculty and practical platforms^[12]. To address these issues, this paper proposes a collaborative education model centered on the integration of "industry, education, research and application", and puts forward specific countermeasures from multiple dimensions such as policy guidance, supervisor team construction, university-enterprise resource integration, and optimization of curriculum and faculty systems.

Guided by the national construction of new engineering disciplines and the reform of professional degree graduate education, colleges should closely align with the needs of industries such as energy and electric power, and continuously optimize the talent training system^[13]. On the one hand, it is necessary to strengthen the top-level design of graduate innovation and entrepreneurship education, build a more systematic, scientific and open education mechanism, and create an innovative cultural atmosphere that encourages exploration and tolerates failure. On the other hand, it is necessary to further promote the "dual-tutor system", give full play to the complementary advantages of on-campus and off-campus tutors in academic guidance and industrial practice, and promote graduate students to exercise innovative thinking and entrepreneurial abilities in real scenarios^[14]. Further efforts should be made to strengthen university-enterprise collaboration, jointly build joint laboratories, internship bases and technology R&D centers, and promote the connection between scientific and technological achievement transformation and industrial application. Through competitions to promote learning and projects to drive practice, graduate students' initiative and creativity should be stimulated, and their comprehensive practical abilities and professional competitiveness should be improved^[15]. In terms of the curriculum system, traditional disciplinary boundaries should be broken, and an interdisciplinary, modular and progressive innovation and entrepreneurship course group should be built, integrating humanistic literacy and engineering ethics education to achieve comprehensive talent cultivation.

Through continuous reform and practice, an innovation and entrepreneurship education system that conforms to the development law of professional degree graduates, meets the needs of industrial transformation and upgrading, and has school-based characteristics and disciplinary advantages should be gradually established. This will provide strong support for the cultivation of high-level applied and innovative talents in China, and also serve as a reference for similar institutions to carry out relevant educational practices.

Disclosure statement

The author declares no conflict of interest.

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