Research on the Integration of Innovation and Entrepreneurship Education with Professional Education in Colleges and Universities

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Abstract： Against the backdrop of the national innovation-driven development strategy, colleges and universities, as the core front for talent cultivation, need to break the current situation where innovation and entrepreneurship education and professional education operate as "two separate entities" and achieve their deep integration. Based on the needs of engineering education reform and combined with the educational teaching practices of colleges and universities, this paper analyzes the necessity of integrating innovation and entrepreneurship education with professional education, examines the existing problems in the current integration process such as disjointed objectives, fragmented content, singular faculty, and lagging evaluation. It proposes specific integration paths from four dimensions: restructuring the curriculum system, innovating teaching models, building the faculty team, and improving the evaluation mechanism. Furthermore, it constructs a multi-collaborative safeguard mechanism to provide theoretical reference and practical guidance for colleges and universities in cultivating interdisciplinary talents with an innovative spirit, entrepreneurial ability, and professional competence.

Keywords: Innovation and Entrepreneurship Education; Professional Education; Educational Integration; Talent Cultivation
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Introduction

With the accelerated advancement of a new round of technological revolution and industrial transformation, societal demand for talent is shifting from "single-specialized" to "innovative and interdisciplinary". The "Implementation Opinions of the General Office of the State Council on Deepening the Reform of Innovation and Entrepreneurship Education in Higher Education Institutions" explicitly calls for "promoting the organic integration of professional education and innovation and entrepreneurship education", integrating innovation and entrepreneurship education into the entire process of talent cultivation. For universities focused on cultivating engineering and technical talents, professional education is the foundation of talent cultivation, while innovation and entrepreneurship education is its extension and expansion. The deep integration of the two is not only key to enhancing students' comprehensive competitiveness but also an inevitable choice for universities to serve the national innovation development strategy and achieve high-quality educational development.

Currently, some universities have carried out practical explorations in integrating innovation and entrepreneurship education with professional education. However, in the actual implementation process, problems such as superficial and formal integration still persist. For example, some universities equate innovation and entrepreneurship education with offering general education courses or organizing business competitions, lacking organic connection with the professional curriculum system; some professional teachers have insufficient understanding of innovation and entrepreneurship education and fail to integrate the cultivation of innovative thinking and entrepreneurial ability into professional teaching. Based on this, this paper, combining the characteristics of engineering professional education, systematically analyzes the

internal logic and practical dilemmas of their integration, explores scientifically feasible integration paths, which holds significant theoretical value and practical significance.

1 The Necessity of Integrating Innovation and Entrepreneurship Education with Professional Education in Colleges and Universities

1.1 An Inevitable Requirement to Conform to the National Innovation-Driven Development Strategy

The national "14th Five-Year Plan and Long-Range Objectives Through 2035" emphasizes "adhering to the core position of innovation in China's modernization drive." As the junction of technological innovation and talent cultivation, universities need to integrate the teaching of professional knowledge with the cultivation of innovation capability and the shaping of entrepreneurial awareness through the integration of innovation/entrepreneurship education and professional education. This will supply high-quality talents with engineering literacy, innovative thinking, and entrepreneurial ability for the nation, contributing to the building of an innovative country.

1.2 The Core Path to Enhance the Quality of Talent Cultivation in Universities

Traditional professional education focuses on knowledge transmission, emphasizing students' mastery of professional theories and skills, but is often deficient in cultivating innovative thinking, practical ability, and entrepreneurial awareness. Innovation and entrepreneurship education emphasizes practice orientation, problem orientation, and interdisciplinary integration, which can compensate for the shortcomings of professional education. The integration of the two can construct a trinity talent cultivation system of "knowledge transmission - ability cultivation - value shaping", enabling students to enhance their ability to discover and solve problems innovatively, as well as the entrepreneurial capability to transform professional achievements into practical value, while mastering professional knowledge. Thereby, it improves the quality of talent cultivation and enhances students' employment competitiveness and career development potential.

1.3 The Internal Driving Force for Promoting the Reform and Development of Professional Education

The integration of innovation/entrepreneurship education and professional education requires universities to break down traditional professional barriers, restructure the curriculum system, innovate teaching models, and optimize the faculty structure. This is essentially a deep reform of professional education. For example, incorporating content such as innovation methods and entrepreneurial management into the curriculum can enrich the connotation of professional education; adopting project-based learning, case teaching, and other methods in the teaching process can enhance the practicality and engagement of professional teaching; introducing industry experts and entrepreneurial mentors into faculty building can optimize the structure of the professional teaching team. This integration can drive professional education to keep pace with the times, adapt to industrial development needs, and enhance the level of professional construction.

2 Existing Problems in the Integration of Innovation and Entrepreneurship Education with Professional Education in Colleges and Universities

2.1 Disjointed Integration Objectives, Lack of Systematic Design

Some universities have unclear positioning of the objectives for integrating innovation/entrepreneurship education and professional education, failing to incorporate the cultivation of innovation and entrepreneurship capabilities into the professional talent training objective system. This leads to a lack of systematic design for their integration. On one hand, the objectives of innovation and entrepreneurship education often remain at the level of "stimulating entrepreneurial interest" or "organizing competition activities", disjointed from the "enhancement of engineering capabilities" and "industry innovation needs" of professional talent training. On the other hand, the objectives of professional talent training still focus on "mastering professional knowledge and skills" as the core, without regarding innovative thinking and entrepreneurial ability as core training indicators. This results in integration becoming an "additional task", difficult to integrate into the entire process of talent cultivation.

2.2 Fragmented Curriculum System, Superficial Integration Level

The curriculum system is the core carrier of educational integration, but currently, the innovation/entrepreneurship courses and professional courses in most universities remain in a "fragmented" state with a low degree of integration. Firstly, course setting is "separated": innovation and entrepreneurship courses mostly exist in the form of general education or elective courses, such as "Entrepreneurship Basics" and "Innovation Methods", lacking content connection with professional core courses and professional practice courses. Secondly, course content is "homogenized": the content of innovation and entrepreneurship courses lacks professional characteristics, failing to design cases and practical projects based on the industry characteristics and technical needs of different majors (such as Mechanical Engineering, Electronic Information, Materials Science, etc.), making it difficult for students to combine innovation/entrepreneurship knowledge with professional knowledge. Thirdly, course credits are "marginalized": innovation and entrepreneurship courses account for a relatively low proportion of credits and are mostly elective credits, resulting in low student participation enthusiasm and difficulty in forming a continuous capacity-building effect.

2.3 Singular Faculty Team, Insufficient Integrated Teaching Capacity

The faculty team is the key support for educational integration, but the current faculty in universities faces the dilemma of "professional teachers not understanding innovation/entrepreneurship, and innovation/entrepreneurship teachers not understanding the profession". On one hand, professional teachers mostly possess solid professional knowledge but lack practical experience and teaching ability in innovation and entrepreneurship, making it difficult to integrate innovative thinking and entrepreneurial cases into professional teaching. On the other hand, innovation and entrepreneurship teachers mostly come from fields such as economics, management, and education, and have insufficient understanding of the technical systems and industry demands of engineering majors, making it difficult to design innovation/entrepreneurship teaching content that aligns with professional characteristics. Furthermore, universities lack cultivation and incentive mechanisms for "dual-qualified" teachers, making it difficult for the faculty structure to meet the needs of integrated teaching.

2.4 Lagging Evaluation Mechanism, Difficulty in Ensuring Integration Effectiveness

A scientific evaluation mechanism is an important means to ensure the effectiveness of educational integration, but the current evaluation mechanisms in universities still have many problems. Firstly, the evaluation subjects are singular: mostly internal university evaluations, lacking participation from external entities such as industry enterprises and social institutions, making it difficult to objectively reflect the match between talent cultivation and industry needs. Secondly, the evaluation content is one-sided: the evaluation of professional education still focuses mainly on student exam scores and thesis quality, while the evaluation of innovation/entrepreneurship ability often uses competition awards and the number of entrepreneurial projects as indicators, failing to construct a comprehensive evaluation system covering knowledge, ability, and quality. Thirdly, the evaluation methods are rigid: mostly using summative evaluation (such as final exams, project defenses), lacking process evaluation (such as class participation, practice logs, innovation proposals), making it difficult to fully reflect students' growth and progress in integrated education.

3 Specific Paths for Integrating Innovation and Entrepreneurship Education with Professional Education in Colleges and Universities

3.1 Restructuring the Curriculum System: "Three Levels, Four Categories" Integrated Modules

Centered on professional talent training objectives and industry innovation needs, construct a "Three Levels, Four Categories" integrated curriculum system. The Basic Level offers cross-disciplinary innovation/entrepreneurship general courses (e.g., "Innovative Thinking and Methods") and integrates innovation cases into professional foundational courses like "Engineering Drawing". The Professional Level adds innovation/entrepreneurship content to core courses, e.g., adding an innovative design module to "Mechanical Design" in Mechanical Engineering, introducing smart hardware entrepreneurship practice into "Embedded Systems" in Electronic Information. The Practice Level integrates professional internships, graduation projects with innovation/entrepreneurship practice, and offers courses like "Professional

Achievement Transformation Practice" relying on professional laboratories. The "Four Categories" are divided by function into Knowledge, Methods, Practice, and Case-based categories, ensuring curriculum completeness and targetedness.

3.2 Innovating Teaching Models: "Three Modes" Integrated Teaching

Implement student-centered "Project-based + Case-based + Interdisciplinary" teaching. Project-based teaching uses real projects as carriers, e.g., "Architectural Structural Design" in Civil Engineering centers on "Green Building Innovative Design" for team practice. Case-based teaching selects innovation/entrepreneurship cases related to the major (e.g., DJI drone R&D) and encourages teachers to transform research and enterprise projects into teaching cases. Interdisciplinary teaching breaks down professional barriers, organizing students from multiple majors to collaborate on projects, e.g., Mechanical, Electronic, and Management majors jointly develop intelligent sorting equipment and write a business plan.

3.3 Optimizing the Faculty Team: "Three Combinations" Integrated Team

Build an integrated faculty team through "internal cultivation and external introduction". For internal cultivation, establish a training system for professional teachers in innovation/entrepreneurship, encourage teachers to take positions in enterprises, and incorporate innovation/entrepreneurship teaching ability into assessments. For external introduction, hire full-time or part-time innovation/entrepreneurship mentors from research teams, enterprises, and incubators. Simultaneously, form interdisciplinary teams, e.g., a mechanical engineering team composed of professional teachers, innovation/entrepreneurship mentors, and enterprise engineers, forming a "Professional + Innovation/Entrepreneurship + Industry" collaborative model.

3.4 Improving the Evaluation Mechanism: "Three Dimensions" Integrated System

Establish a scientific evaluation system to ensure integration effectiveness. Evaluation subjects cover the university (evaluating basic professional and innovation/entrepreneurship abilities), the industry (evaluating mastery of industry standards), enterprises (evaluating practice and professional literacy), and social institutions (evaluating the value of entrepreneurial projects). Evaluation indicators include four dimensions: professional knowledge, innovation ability, entrepreneurial ability, and professional quality. Evaluation methods adopt a combined model of "Process Evaluation ($\geqslant$ 50%, including class participation, practice logs, etc.) + Summative Evaluation (including exams, project defenses, etc.)", comprehensively reflecting student growth.

4 Safeguard Mechanisms for the Integration of Innovation and Entrepreneurship Education with Professional Education in Colleges and Universities

4.1 Institutional Safeguards: Improve Integrated Education Management Systems

Universities need to establish and improve integrated education management systems to provide institutional support for integration practices. Firstly, formulate the "Implementation Measures for the Integration of Innovation and Entrepreneurship Education and Professional Education", clarifying integration objectives, task division, and safeguard measures. Secondly, incorporate integrated education into the professional construction evaluation system, making it an important basis for professional ranking and resource allocation, incentivizing various majors to actively promote integration reform. Thirdly, establish a special fund management system for integrated education, setting up a special fund for the integration of innovation/entrepreneurship education and professional education, used for curriculum construction, teacher training, practice platform building, etc., ensuring the smooth progress of integration work.

4.2 Resource Safeguards: Build Diverse Integrated Practice Platforms

Integrate internal and external resources to build "on-campus + off-campus" diverse integrated practice platforms, providing students with practice venues and resource support. On-campus, rely on professional laboratories and engineering training centers to build "Professional + Innovation/Entrepreneurship" integrated laboratories equipped with advanced experimental equipment and innovation tools. Off-campus, cooperate with leading industry enterprises, startup incubators, and research institutes to establish off-campus practice bases, conducting joint training, project cooperation, internship and

training activities, allowing students to enhance their professional and innovation/entrepreneurship abilities in real industry environments.

4.3 Collaborative Safeguards: Construct a "University-Government-Enterprise-Research Institute" Collaborative Education Mechanism

Break the single education model of universities and construct a "University - Enterprise - Government - Research Institute" collaborative education mechanism. The government is responsible for issuing supportive policies for integrated education, providing financial support and policy guidance. Enterprises provide practice positions, project resources, and industry experts, participate in the formulation of talent training plans and teaching evaluations. Research institutes provide research resources and technical support, guide students to participate in cutting-edge research projects, and cultivate students' scientific research innovation ability. Universities are responsible for coordinating resources from all parties, organizing teaching implementation and talent cultivation, forming a collaborative education pattern of "four-party linkage and complementary advantages".

5 Conclusion and Outlook

The integration of innovation and entrepreneurship education with professional education in colleges and universities is a systematic project that requires coordinated advancement from multiple dimensions such as objective design, curriculum system, teaching models, faculty team, and evaluation mechanism. By analyzing the necessity and existing problems of their integration, this paper proposed integration paths including the restructuring of the "Three Levels, Four Categories" curriculum system, the innovation of "Project-based + Case-based + Interdisciplinary" teaching models, the optimization of the "Professional Teacher + Innovation/Entrepreneurship Mentor + Industry Expert" faculty team, and the improvement of the "Multi-subject + Comprehensive Indicators + Process Evaluation" evaluation mechanism. It also constructed a trinity safeguard mechanism of institution, resources, and collaboration, providing references for the integrated education practice of universities.

In the future, with the deepening advancement of the innovation-driven development strategy and the continuous deepening of higher education reform, universities need to further strengthen theoretical research and practical exploration of integrated education, designing personalized integration schemes based on the characteristics of different majors (e.g., engineering, liberal arts, sciences). Simultaneously, it is necessary to strengthen the combination of information technology and integrated education, utilizing technologies like big data and artificial intelligence to optimize the teaching process and evaluation system, enhancing the intelligent level of integrated education. It is believed that through continuous reform and innovation, universities can achieve the deep integration of innovation/entrepreneurship education and professional education, cultivate more interdisciplinary talents with an innovative spirit, entrepreneurial ability, and professional competence for the country, and provide solid talent support for the construction of an innovative country.

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