

# Study on the Enhancement of Professional Capacity of Master's Students in Transportation under the Mode of Cross-border Educational Cooperation

Yanhai Yang\*, Shangfeng Yang, Ye Yang, Meichi Lu

*School of Transportation and Geomatics Engineering, Shenyang Jianzhu University, Shenyang, Liaoning, China*

*\*Corresponding Author.*

**Abstract:** This article conducts an exhaustive exploration into the pivotal matters pertaining to the nurturing of professional master's students in transportation. It conducts a meticulous analysis of diverse inadequacies manifested in the extant cultivation paradigm, such as the monotonous character of teaching approaches, the insufficient synergy between educational institutions and enterprises, and the comparatively feeble practical capabilities of students. To confront these challenges, it is proposed that a "trinity" collaborative cultivation system be erected. Furthermore, interdisciplinary courses necessitate innovation, the school-enterprise collaboration model ought to be further refined, and endeavors to enhance engineering practical ability must be intensified. The ultimate objective is to precisely delineate the cultivation objective that integrates theoretical knowledge, practical ability, and innovative thinking. The valuable research outputs can provide both theoretical and practical direction for the cultivation of high-quality talents in the domain of transportation, thereby efficaciously catering to the demands of the contemporary epoch characterized by the development of new quality productivity.

**Keywords:** New Productivity; Transportation; Professional Master's Degree; Professional Ability Improvement

## 1. Introduction

Since the establishment of the professional degree education system in 1991, China has gradually built up a high-level and application-oriented talent cultivation system,

which has greatly contributed to economic and social development. With the continuous development of postgraduate professional degree education, the cultivation system has entered a whole new stage. As an important form adapted to market demands, the establishment of professional degrees aims to meet the diverse talent needs of the economy and society. In recent years, the enrollment of professional master's degrees has continued to increase, with the proportion of institutions and specialties exceeding 60%. It is expected to dominate postgraduate education in the future. The newly established Master's accreditation units and fields are also dominated by professional degrees, fully demonstrating their importance and potential for development.[1]

By integrating the distinctive training characteristics of professional master's programs with the demands of "new quality productivity," we aim to enhance the overall capabilities of professional master's students in higher education institutions. The core characteristics are presented in Figure 1. By training professional master's students who align with the development needs of the new era, we will provide the necessary talent to drive the advancement of new quality productive forces. The advancement of new quality productive forces provides a strategic direction for talent training in universities, fostering the comprehensive development of education, science, technology, and human resources. From this perspective, universities serve as a key driving force and strategic core in advancing the enhancement of new quality productivity. Concurrently, the active development of new productive forces has provided ongoing momentum for the reform of universities. In light of society's demand for

master's degrees in transportation, postgraduate education should prioritize cultivating application-oriented, high-level professionals who can drive the high-quality development of the transportation industry. Currently, the training process for professional master's degree students faces numerous challenges. As demonstrated in the preceding analysis, universities function as the pivotal centres for fostering scientific and technological advancement, nurturing high-calibre talent and spearheading innovative endeavours. They possess distinctive resource advantages, substantial development potential and strategic

opportunities. It is imperative to align with this prevailing trend, possess profound insight into the deficiencies existing in the training of professional masters, continuously improve the training mode and education system, and provide strong support for achieving high-quality development in the new era. The present article takes the transportation major of Shenyang Jianzhu University as the research object, carries out a profound analysis of the main challenges currently faced in postgraduate training, and explores the innovative paths to enhance the professional capabilities of professional master's degree students majoring in transportation.

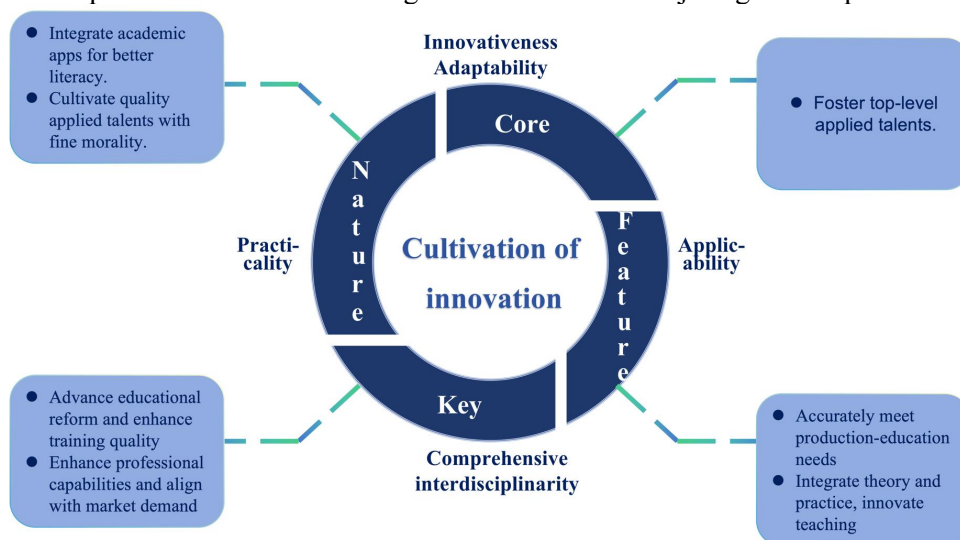


Figure 1. The Core Characteristics

## 2. Professional Master's Degree Training Objectives and Course Categories

### 2.1 Training Goals

The postgraduate training system in transportation at Shenyang Jianzhu University focuses on enhancing professional competence by integrating the characteristics of this degree program with industry needs. It aims to cultivate high-level applied talents with a solid theoretical foundation, systematic knowledge in transportation engineering, and strong engineering practice skills.

### 2.2 Course Categories and Credit Requirements

For example, the transportation professional master's program at our institution is classified into two categories: degree courses and elective courses. The curriculum is presented in Figure 2. The degree courses consist of two

modules: "Basic General Courses" and "Professional Skills Courses," designed to enhance students' moral quality, foreign language proficiency and professional capabilities. The elective courses are organized into two modules: "Industry Frontier Courses" and "Quality Improvement Courses," aimed at strengthening students' practical skills, understanding of industry frontiers, and overall quality enhancement. Professional degree graduate students are required to complete 31.5 to 34.5 credits, with 18 to 19 credits from degree courses, 9.5 to 11.5 credits from elective courses, and 4 credits from compulsory courses. Theory courses total 18 credit hours (1 credit per hour), while other courses amount to 16 credit hours, also valued at 1 credit per hour. Degree courses are limited to a maximum of 4 credits each (excluding the first foreign language course), whereas elective courses are capped at 2 credits each.

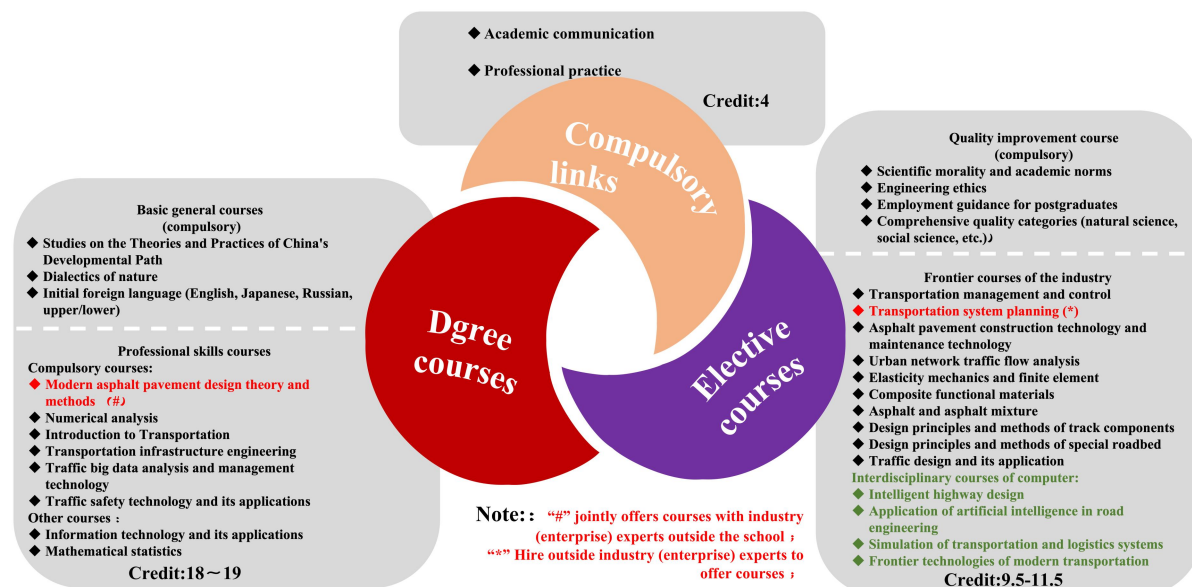


Figure 2. The Curriculum

### 2.3 Professional Practice

Professional practice is an essential component of the postgraduate training system. The University implements a dual tutor system, adopting a flexible training model that combines coursework, professional practice, and dissertations. Senior engineers and technicians from outside the University with extensive practical experience co-supervise postgraduates. During their studies, professional postgraduates must complete at least six months of practical training, aimed at developing their ability to identify and solve practical problems. The form of practice can be flexibly arranged, combining centralized and sectional practice, on-campus and on-site practice, or relying on joint cultivation bases with industrial enterprises. It may also integrate on-campus research projects with off-campus co-supervisors' resources to enhance the comprehensive quality and professional abilities of postgraduates.

## 3. Shortcomings in the Training Model for Master's Degree in Transportation Majors

### 3.1 The Overly Traditional Teaching Model Resulting in A Disconnect between Theory and Practice

In certain universities, the prevalent teacher-centered approach and standardized assessment system have resulted in a misalignment between the educational content and the actual needs of students, particularly in postgraduate transportation education.

Moreover, assessment methods are predominantly based on written examinations, overlooking the evaluation of students' practical competencies and innovative capabilities [2]. Furthermore, factors such as limited research funding present challenges in conducting practical teaching activities, thereby further exacerbating the gap between theory and practice. These challenges have impeded professional graduate students' acquisition of cutting-edge knowledge and practical skills, thereby limiting their ability to adapt to industry advancements and market demands. Consequently, higher colleges must urgently reform their teaching models, enhance the integration of theory and practice, and proactively establish practical training platforms to cultivate highly skilled professionals capable of meeting the evolving demands of the modern era.

### 3.2 Homogenization of Forms of Training

To meet the development needs of the new era, the Ministry of Education is continuously enhancing the professional postgraduate education system and evolving a training model that adapts to changing times. In this context, universities have successfully cultivated numerous interdisciplinary, applied, and innovative professionals who contribute to national development. [3] However, as the transportation industry faces increasing complexity and technological demands, some universities still rely on the traditional academic training model. Despite the gradual incorporation of practical and research

elements into the professional master's model, this approach remains insufficiently aligned with both assessment and curriculum requirements. As a result, it fails to effectively demonstrate the practical and application-oriented nature of professional master's education, limiting students' ability to address real-world engineering challenges. This deviates from the goal of cultivating well-rounded, application-oriented professionals.[4] To better meet the needs of the transportation sector, the professional master's training model must undergo further innovation, ensuring a balanced integration of theory, practice, skills, and innovation.

### 3.3 The Lack of Close Integration and Collaboration within the Faculty Team

The dual-tutor cultivation model enhances postgraduates' professional practice abilities, teamwork, and innovation and application skills. For colleges and universities, the active involvement of enterprise tutors in postgraduate training helps them stay updated with the latest industry trends, thereby enhancing postgraduates' competitiveness in the job market. Universities can refine their curriculum by leveraging valuable resources from enterprises, cultivating high-level applied talents to meet the evolving needs of society.[5] However, due to insufficient supervision and oversight, the collaboration between enterprise and university tutors remains weak. As a result, the dual-tutor training model fails to effectively improve students' practical skills and leads to inefficient use of institutional resources.

### 4. Strategies and Suggestions for Enhancing Professional Competence of Master's Degree Students in Transportation Engineering

The cultivation of professional master's degree postgraduates at the highest level is the fundamental objective of universities, constituting a pivotal element in professional degree education. In order to promote the construction of a new type of high-quality productive forces, it is necessary to focus on cultivating high-end talents with excellent professional skills and innovation capabilities. This strategic decision is pivotal in aligning with the national demand for high-quality development and represents a crucial

component in enhancing the talent cultivation system for this new type of high-quality productive forces. The theory of new quality productivity presents a formula for comprehensively assessing the enhancement of social productivity: new quality productivity = (revolutionary breakthroughs in science and technology + innovative allocation of production factors + profound industrial transformation and upgrading) × (labor force + labor tools + labor objects) in an optimized combination.[6]

The present study proposes a novel approach to the cultivation of postgraduate students in the field of road transportation. The proposed approach is founded on the theory of new quality productivity, which posits the integration of theoretical knowledge, engineering practice and innovative thinking. The optimisation of collaborative allocation of multi-dimensional elements is also a key tenet of the proposed approach. This study proposes an innovative multi-dimensional collaborative training model, (e.g., Figure. 3 Collaborative Education Mode) which is constructed by analysing the deficiencies of the current training mode and the talent demand in the context of new quality productivity. Under the joint guidance of discipline teams and enterprise tutors, this model emphasizes deep cross-disciplinary integration. On-campus cultivation centers on moral development and theoretical learning, incorporating three key aspects: matching content with students' cognitive development, fostering theory-practice integration through a diversified curriculum, and optimizing teaching effectiveness with a scientific curriculum system. Off-campus training leverages enterprise-based case teaching, focusing on stimulating students' innovative thinking and engineering practice skills, thus laying a solid foundation for improving their overall professional abilities.

To clarify the cultivation path, the following formula is proposed based on the new quality productivity theory (e.g., Figure 4. Theoretical Formula): the enhancement of professional ability in master's students of road transportation = (The depth of theoretical knowledge + Techniques of engineering practice + The cultivation of innovative thinking) × (The guidance of academic teachers + The guidance of industry mentors +

The support of practice bases) in an optimized combination. The formula indicates that in order to enhance the abilities of postgraduate students majoring in transportation, it is necessary to integrate multiple resources, focus on the integrated integration of theory

and practice, and especially strengthen the effective linkage between the guidance of supervisors and the support of practice bases under the framework of industry-university collaboration.

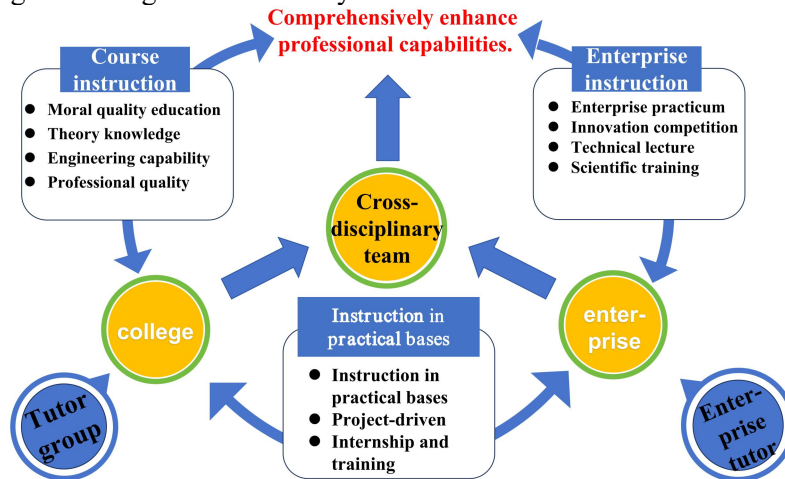


Figure 3. Collaborative Education Mode

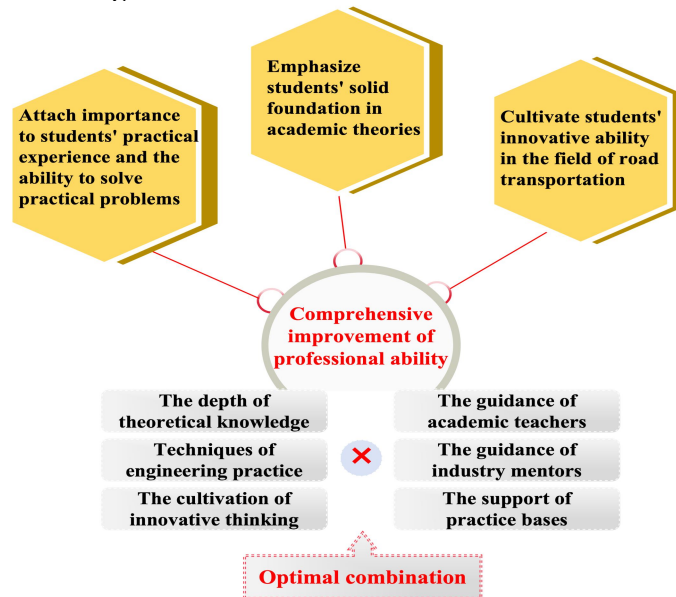


Figure 4. Theoretical Formula

#### 4.1 Innovation of Interdisciplinary Curriculum System and Cultivation of Moral Quality

In recent years, with the rapid development of new productive forces, there has been a continuous increase in social demand for high-quality talent, with greater emphasis on the deep integration of comprehensive qualities, innovation ability and professional skills. Consequently, the training programme for professional degree postgraduates must prioritise enhancing professional ability, with curriculum design playing a pivotal role in

facilitating practical application and stimulating innovation. The curriculum system is not only the cornerstone of the knowledge framework and skill cultivation of postgraduates, but also an important support for shaping the professional ability structure. Consequently, the curriculum setting must align with the needs of students and prioritise enhancing professional ability. A comprehensive analysis of students' learning characteristics and the developmental needs of the industry and society is imperative to ensure that the reform measures are closely aligned with actual requirements. The improvement of

professional ability must be prioritised in order to optimise training programmes and achieve the goal of cultivating high-quality talent.

An innovative cross-disciplinary curriculum system is key to enhancing the professional competence of master's students in transport and should focus on consolidating the practical foundation and improving professional competence. This highlights comprehensive "three-pronged education" reform, creating a three-dimensional integrated collaborative education model and optimizing the entire cultivation process through the flexible "one class, one teacher, one mentor" system. Theoretical teaching should follow cutting-edge trends in transport, systematically imparting core professional skills and knowledge, while opening platforms like the "Transportation Forum" and "Jiaotong Zi Lecture Theatre" to help students stay updated on industry developments. The teaching design emphasizes diverse methods like group cooperation and seminars to stimulate independent learning, enhance knowledge internalization, and improve application skills. The course assessment should be centered on cumulative evaluation, accomplish profound integration of theory and practical issues through case teaching, and augment the application of digital technologies, such as digital space modeling and data visualization.[7] The integration of VR technology into the designed teaching practice environment can significantly enhance the immersion and interactivity of the educational framework. Therefore, this advancement is likely to provide learners with a more effective and focused learning experience. By means of the development of an online learning platform, the consolidation of enterprise resources and case banks, and the optimization of the teacher-student interaction mechanism, it is feasible to comprehensively facilitate the all-round enhancement of students in terms of theoretical comprehension, practical capacity and innovation quality.

Furthermore, in the new era of transport construction, many engineering problems exceed the scope of traditional disciplines, requiring cross-disciplinary integration for innovative solutions. Cross-disciplinary integration is crucial for both the development of high-level talent and the evolution of the discipline itself.[8] University curricula should

integrate BIM, big data, deep learning, and other cutting-edge technologies, focusing on multidisciplinary and cross-cutting transport areas to cultivate interdisciplinary thinking and technology application skills. Cross-disciplinary integration relies on internal collaboration and cross-college cooperation to break knowledge barriers, stimulate original research, and provide systematic solutions for complex engineering problems, thereby enhancing students' professional abilities and comprehensive literacy.

In advancing the intersection and integration of disciplines, higher education institutions must fully recognize the pivotal role of Moral quality-oriented Education in talent development. This type of education is not only central to the advancement of academic disciplines but also serves as a strategic foundation for the social progress and development. By offering courses that bridge theory with practice, innovating teaching methods, and adopting a cumulative assessment model focused on the learning process, we aim to deepen students' moral quality, enhance their social responsibility, and strengthen their professional ethics and values. These efforts are essential in cultivating professionals capable of meeting the demands of emerging industries and new productive forces.

Moreover, integrating moral quality education into the curriculum helps students stay abreast of major industry strategic priorities, industry trends, and the latest developments within their disciplines. Creating open dialogue platforms fosters broader academic perspectives and improves practical application. This approach also addresses the real-world challenges students face in their learning and research, providing rapid solutions to problems and offering valuable feedback to continuously optimize curriculum systems and talent training mechanisms.

The core concept of cultivating talents with both ability and the improvement of moral quality and professional ability is to be deeply integrated into every aspect of teaching, research, management, and service through systematic reconfiguration of the curriculum framework, innovative teaching and assessment methods, strengthening interdisciplinary synergies, and improving educational mechanisms. This comprehensive

approach is designed to enhance students' ideological and moral quality, as well as their professional practical abilities. It is expected to provide a robust talent pool to meet the industry's significant needs and contribute to the successful realisation of the objective of establishing a robust transportation infrastructure.

#### **4.2 Develop A Robust and Efficient Model for Talent Cultivation and Training.**

Postgraduate education must strengthen its role in serving national and societal development, accelerate structural adjustments, and align talent training with economic and social needs.[9] Unlike traditional academic master's programs, professional master's education emphasizes the development of practical and professional skills. Transportation professional master's programs must closely align with industry demands, developing a training model for innovative and applied personnel to meet the high-level talent needs of new quality productivity.[10] The educational objective of the master's degree program in transportation should be defined as possessing a robust theoretical basis, remarkable practical capabilities, and distinct professional attributes. In contrast to the academic master's degree which centers on theoretical profundity, this mode lays greater stress on industry services, practical orientation, and the enhancement of comprehensive qualities.[11] The program should address the technological needs of the transportation industry, cultivating skilled professionals capable of adapting to emerging productivity demands. Efforts should focus on optimizing application-based courses with professional characteristics, using case studies, internships, and simulation projects to enhance students' problem-solving skills and research capabilities. Maintaining a balance between theoretical and practical courses is essential for developing students' engineering skills, practical application, and overall quality, ensuring strong practical abilities while reinforcing the theoretical foundation.

Scientific research projects and engineering practice platforms assume a paramount role in the fostering of master's students concentrating on transportation. Universities are obliged to exploit national research funds and key engineering projects to the fullest, furnish

students with practical opportunities, cultivate their autonomous innovation capabilities, uplift their engineering skills, fortify their ability to contend with industry challenges, and thereby forge competitive professionals. The quintessence of professional master's education lies in nurturing students' practical and application capabilities. Therefore, a professional master's thesis in transportation should differ from an academic thesis, with practical relevance as a key criterion for topic selection, methodology, and outcomes. Research papers should emphasize practical applicability, ensuring that the results contribute directly to engineering solutions. Furthermore, universities should strengthen industry collaboration to design training programs that align with the specific needs of transportation disciplines. An assessment system should be established to integrate practical training into the curriculum, with a clear allocation of credits for practical courses. This system should incorporate performance in practical courses into final evaluations, aligning educational outcomes with industry demands, promoting knowledge transfer, and enhancing students' employability and industry integration.

#### **4.3 Emphasize the Advancement of Deep Integration and Innovative Development between Industry, Academia, and Research.**

The theory of new quality productivity provides a pivotal framework for cultivating high-level applied talents in the transportation sector, with a strong emphasis on the integration of industry, education, and research to enhance postgraduate competencies. This integration hinges on the alignment of educational curricula with industry demands, ensuring that graduates possess the requisite professional skills and meet industry standards, thereby bridging the gap between academia and the labor market.

The efficient fusion of theoretical knowledge, practical skills, and innovative thinking offers a pathway for harmonizing academic expertise with real-world applications, addressing the critical need for advanced talents in society.[12] In light of the new quality productivity theory, universities and enterprises should collaboratively foster a model that integrates on-campus education, off-campus practice, and applied learning.



This model not only serves as an innovative mechanism for talent cultivation but also acts as a vital conduit for advancing the practical application of new productivity paradigms in the transportation field.

To optimize the integration of industry, education, and research, universities should refine their talent development systems through the following strategies: (1) curriculum alignment: educational programs should be meticulously aligned with current industry needs, incorporating insights from experienced professionals and industry leaders. Universities should appoint senior experts with substantial practical experience as external mentors, offering students specialized guidance and real-world expertise. (2) industry collaboration: universities should invite industry representatives and distinguished alumni to deliver academic lectures and seminars, providing students with access to cutting-edge trends and advancements within the transportation sector. This initiative broadens students' professional horizons and enhances their understanding of industry dynamics. (3) integrated training models: a comprehensive, multidimensional training model that merges theoretical education, practical internships, and applied research should be developed. This model should aim to equip students with both foundational knowledge and the practical skills required to thrive in complex, real-world environments. (4) practical application and research integration: universities and enterprises must jointly establish efficient practice bases that focus on personalized student development, particularly in fostering innovation capabilities. These bases should offer diverse roles and practice projects, enabling students to select projects based on their skill sets and interests. The collaboration should be centered on ensuring that academic mentors provide robust theoretical support, guiding students to identify industry-specific challenges, propose viable solutions, and engage in meaningful research. (5) innovation and entrepreneurship: innovation competitions, research showcases, and other activities should be regularly organized within the practice base, fostering an environment conducive to entrepreneurial thinking and practical problem-solving. A reward system should be established to

incentivize student participation in innovative and entrepreneurial endeavors within the transportation field. (6) curriculum and industry R&D Integration: ongoing research and development projects within enterprises should be seamlessly integrated into the university curriculum, including thesis topics, design projects, and other academic requirements. This integration allows students to apply theoretical knowledge to real-world challenges, enhancing both their practical expertise and research capabilities.

In this collaborative ecosystem, both academic and industry mentors should provide dual guidance, ensuring that students not only develop technical competencies but also cultivate a comprehensive, innovative approach to addressing complex engineering problems. The establishment of a rigorous assessment framework for practical training, combined with regular feedback from both academic and industry partners, will further align educational outcomes with industry standards, thereby reinforcing the continuous enhancement of postgraduate competence in the transportation sector.

These measures will foster close collaboration between academia and industry, establish a robust quality supervision system, and facilitate the integration and innovation of industry, academia, and research, thereby enhancing the quality and efficiency of talent development and advancing school-enterprise cooperation from "accumulation" to "integration." For instance, Our university jointly established a postgraduate training base in collaboration with Liaoning Provincial Transportation Planning and Design Institute Co., Ltd. in 2015. In 2018, this base was acknowledged as a demonstration base for professional degree postgraduate training by Liaoning Province, a recognition that fully embodies its prominent influence within the industry. Through immersive participation in the engineering cases and projects of the enterprise, students have markedly enhanced their practical capabilities and professional qualities. This platform has facilitated extensive and in-depth exchanges and cooperation between students and enterprises. Enterprises have provided abundant practical resources, while universities have focused on cultivating professional talents with high-level capabilities. The synergy arising from the



sharing of resources and the complementary strengths of both universities and enterprises has catalysed the translation and implementation of scientific and technological achievements, thereby providing a substantial impetus to the innovative development of the transportation industry.

### 5. Conclusion

In the context of the new era, professional skills have emerged as the central competitive advantage of transportation master's students, serving as a key driver for advancing the development of high-quality productivity. Guided by innovative educational concepts, we must prioritize the deep integration of theory and practice, refine teaching methods and training models, and promote collaboration between industry, academia, and research. These efforts will collectively enhance the training quality and professional competencies of graduate students. Colleges should focus on systematically improving professional master's degree training models, aligning closely with industry development needs and quality enhancement objectives, and aiming to cultivate high-quality applied talents with strong professional qualities and critical thinking skills. These measures will provide robust talent support for the nation's social progress and economic prosperity, while also contributing technical expertise to industrial and societal development.

### Acknowledgments

This paper is supported by Postgraduate Education Reform Project of Liaoning Province, Practice and exploration of cultivating practical innovation ability of professional degree graduate students (No.LNYJG2022247)

### References

- [1] Wu Jinjiao. The classified development pattern of graduate education in my country has basically taken shape. *Wen Wei Po*, 2023-12-20(006).
- [2] Tang Yang, Zhu Faxin, Zhang Jianwei, et al. Research on the paths to improve the practical ability of professional master's students - taking the transportation major of Zhejiang Ocean University as an example. *Shanxi Youth*, 2024, (02): 135-137.
- [3] Liu Huiqin. Create a professional degree graduate training system with Chinese characteristics. *"China Education News"*, 2022-6-17(5).
- [4] Yang Weiwei. Research on teaching reform from the perspective of cultivating innovative practical ability of professional degree master's students. *Knowledge Window (Teacher Edition)*, 2022, (08): 69-71.
- [5] Lu Liqun, Zhao Jing, Li Ruixian, etc. Research on the school-enterprise joint training model for transportation professional degree graduates. *University Education*, 2018, (05): 16-18.
- [6] Lin Qingning, Li Jingdong, Mao Shiping. Theoretical logic, Chinese practice and focus on the formation of new agricultural productivity. *Journal of Northwest A F University (Social Science Edition)*, 2024, 24(06): 1-10.
- [7] Li Yongfei, He Guiying. Construction of postgraduate course system for transportation major in the digital era. *Internet of Things Technology*, 2023, 13(11): 130-132+135.
- [8] Lian Meiling. Exploration of the training model for postgraduate students majoring in transportation based on interdisciplinarity. *Education and Teaching Forum*, 2023, (48): 96-99.
- [9] Ministry of Education of the People's Republic of China. Several opinions of the Ministry of Education on the training of full-time professional master's degree graduates. 2009-03-19.
- [10] Wang Zhuo. Analysis of the training model for innovative and applied talents in transportation majors under the new engineering concept. *China Modern Educational Equipment*, 2022, (21): 97-99.
- [11] Chen Yan, Tie Xiaorui. Research status and trends of professional degree graduate education in my country - based on the perspective of bibliometric analysis (2000-2020). *Graduate Education Research*, 2021, (02): 61-67.
- [12] Shen Qihong, Shao Rong. Research on talent cultivation of "integration of industry, teaching and research" in my country's graduate education. *Chinese Adult Education*, 2017, (21): 63-65.