

Study on the Training Model of the Combination of Production, University, and Research of Transportation Graduate Students

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Abstract: To solve the disjointed problems of teaching, research, and practice among schools, transportation planning departments, traffic management departments, and enterprises, a training model combining production, university, and research for transportation graduate students was established. The construction of a transportation engineering platform can provide a reference for the innovative training mode of engineering graduate students, and also provide ideas and means for the combination of production, study, and research of other majors. Under the operation of the scientific mode, it can achieve the goal of teaching and learning and the win-win situation of the school and enterprise to realize the effect of “one plus one is greater than two.”

Keywords: Combination of production, university, and research; Training mode; Transportation; Graduate students; Internship base

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1. Introduction

With the rapid growth of China's economy and the improvement of people's living standards, car ownership has repeatedly reached new highs, bringing convenience to the nation, but also produced a series of problems such as traffic congestion, traffic safety, and energy consumption^[1]. Under the new situation, the transportation discipline continues to use the traditional concept and model of talent training, which does not meet the internal requirements of talent training and the trend of talent demand development, so it is imperative to combine the training mode of production, university, and research^[2].

2. Analysis of the current situation of the teaching mode combining production and study

2.1. Analysis of foreign research status

Foreign countries started early in the training of talents in teaching and scientific research departments

and enterprises, and have formed a mature training model. Japan began to pay attention to scientific and technological cooperation between universities and enterprises in the 1930s. After decades of development, it has established various forms of horizontal association such as joint research systems, cooperative research systems, and contract systems^[3]. British entrepreneurs have played an important role in promoting industry-university cooperative education. They serve in key institutions such as educational foundations, directly join the school leadership core, participate in the formulation of vocational qualification standards and school evaluation, provide financial assistance to schools in various ways, establish cooperative school-running systems with schools, and provide practical training equipment and venues. The training of graduate students in the United States shows a diversified trend. The combination of basic research and applied research is adopted to establish a wide range of cooperative relations with society, which further improves the training quality of graduate students and their adaptability to future work^[4]. Most universities in Canada have a cooperative education Ministry, which is mainly responsible for the macro-management, coordination, and service of school-enterprise cooperative education, and the specific organization and implementation work is responsible for the faculty of each school department. It can be seen from this that the education system of Western countries continues to innovate with the development of time, and has finally formed the current relatively complete education system. The allocation of theoretical learning in school and work practice in enterprises is reasonable, and the time for work practice in enterprises is guaranteed^[5].

2.2. Analysis of the current situation of the research on the combination of industry and education in domestic transportation engineering

The discipline of transportation engineering in China is generally regarded as a soft discipline, which is not enough to solve the practical problems of the social industry. The research results in the training mode of industry-university-research personnel are rarely reported, and it is still in the exploration stage. At present, most of China's traffic and transportation engineering graduate students are only short-term practices and lack systematic implementation steps and long-term implementation planning. They have not yet formed their characteristics in the aspect of talent training, the support of society and enterprises for talent training is small, and the adaptability of talents to social needs is limited. Given this, Wu et al., aiming at the problems existing in the cultivation mode of innovative talents and the construction of innovative campuses, take the cultivation of innovative ability of transportation talents as an example and put forward the cultivation method of innovative ability of talents under the mode of academic community^[6]. He combined the current situation of the construction of enterprise post-doctoral workstations in the field of transportation, aiming at the development difficulties of production, university, and research, such as imperfect innovation process and insufficient scientific research funds, systematically analyzed the limitations of the construction of post-doctoral workstations in promoting the transformation of results and the development of industrialization, and put forward four major measures for the integration of production, university, and research^[7]. According to the characteristics of China's urban rail transit field, Zhang built a market-oriented, enterprise-oriented, scientific and technological innovation as the driving force, with funds, contracts, and agreements as the link, using the combination of scientific research and demonstration projects of industry-university-research joint innovation management^[8]. Feng et al. analyzed the implementation background of the integration mode of industry, university, research, and use of business, aiming at the problems existing in the current situation of rail transit colleges and universities such as insufficient adaptation of talent concept, insufficient update of professional knowledge system and insufficient change of training mode, and combined with the new requirements for talent training in rail transit colleges and universities under the background of new engineering, they put forward

the mode and path of integration of industry, university, research and use of business ^[9]. In combination with the implementation of the new engineering policy, Miao discussed the problems existing in the education of vehicle engineering, including teaching content, teaching form, teaching equipment, teacher team, and students' awareness of initiative innovation ^[10].

3. Apply the advantages of production-learning combined teaching mode

3.1. Achieve a win-win situation in the case of school-enterprise cooperation

In the process of learning, the postgraduate students of transportation engineering in the university mainly focus on theories, most of the topics studied are soft, case teaching and practical teaching resources are insufficient, and most of them use simulation and other means to replace them, so there is a common disconnection between teaching, research, and practice ^[11]. Graduates often need a long adapting period before they can formally carry out relevant work in their jobs ^[12]. At the same time, the traffic planning, traffic design, traffic management departments, and related units are weak in technical strength, lack support for new technologies and new theories, adhere to stereotypes, and are helpless in the face of the outstanding contradictions of the rapid development of private cars and the lag of urban traffic infrastructure ^[13]. The establishment of the training mode platform combining production, university, and research can well solve the problems existing in schools and traffic planning, traffic management departments, and related units, and can achieve a win-win situation under the operation of the scientific mode, realizing the effect of "one plus one is greater than two" ^[14].

3.2. Cultivate more excellent practical talents

The combination of production, university, and research can solve the problem of separating teaching from practice, enrich the topic selection of the thesis, and enable the graduate students to practice in the study and learn in the practice, which not only has a high degree of theoretical knowledge but also can solve practical problems ^[15]. Learning while using can make students better grasp professional knowledge and also greatly stimulate students' interest in learning, play their potential, and enhance the sense of responsibility, which is conducive to training more excellent theory and practice combinations of talents.

3.3. Improve the cultivation of innovative talents for engineering majors

The combination of industry, university, and research can bring new development trends and development direction information for the front-line staff of traffic planning, design, and management, solve the current traffic problems from a theoretical perspective in the process of practical work, and provide the most advanced technical support for solving practical difficulties ^[16]. The construction of the platform for the combination of industry, university, and research of transportation engineering can provide a reference for the innovative training mode of engineering graduate students, and also provide ideas and means for the combination of industry, university, and research of other majors. The research results will reflect the quality development goal of higher education, follow and reflect the law of education and teaching, and provide guidance for the further improvement of professional training programs.

In response to these problems, a series of improvement and perfection measures are put forward to improve the training quality of excellent engineers for new energy vehicles and promote the development of the industry. The operation mode of industry-university-research cooperation is shown in **Figure 1**.

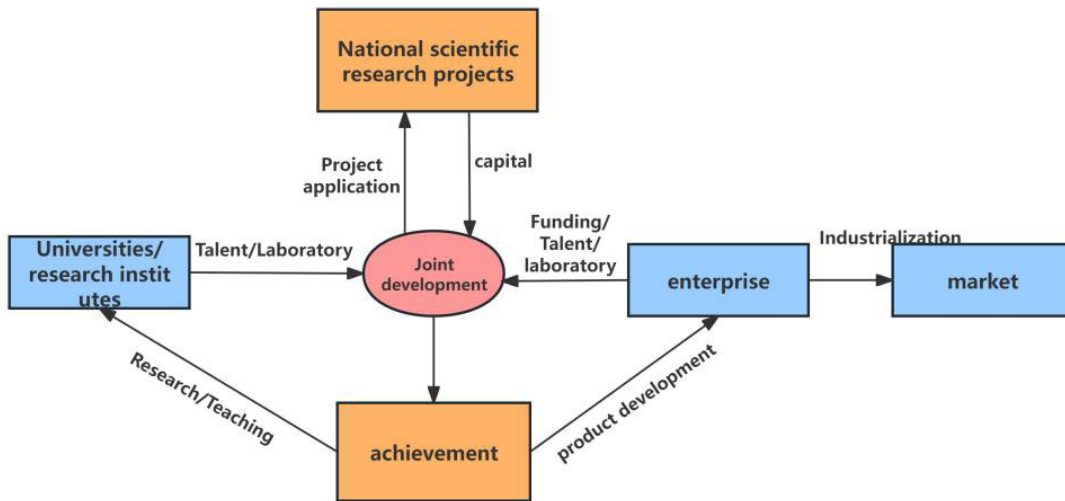


Figure 1. Operation mode of industry-university-research cooperation

4. Thinking and measures of transportation talents in the mode of combining production with study

4.1. Clarify the positioning of talents and optimize the training mode of transportation talents

First of all, through the investigation of the current situation of the transportation graduate training mode in domestic and foreign universities, the evolution law of the graduate training mode is sorted out and analyzed, with the basic patterns and characteristics of the development of the graduate training mode in advanced disciplines are summarized, and the main problems and root causes of the transportation graduate training mode are explored. Define the connotation of the transportation industry-university-research training mode, combine the needs of graduate students in practice and experiment and the investigation results of the industry technology and theoretical needs of cooperative units, and build a framework system of the industry-university-research training mode for transportation graduate students from the aspects of curriculum setting, project research and construction of production practice bases to provide a basis for the construction of the transportation graduate training mode. The operation process of the industry-university-research cooperation base is shown in **Figure 2**.

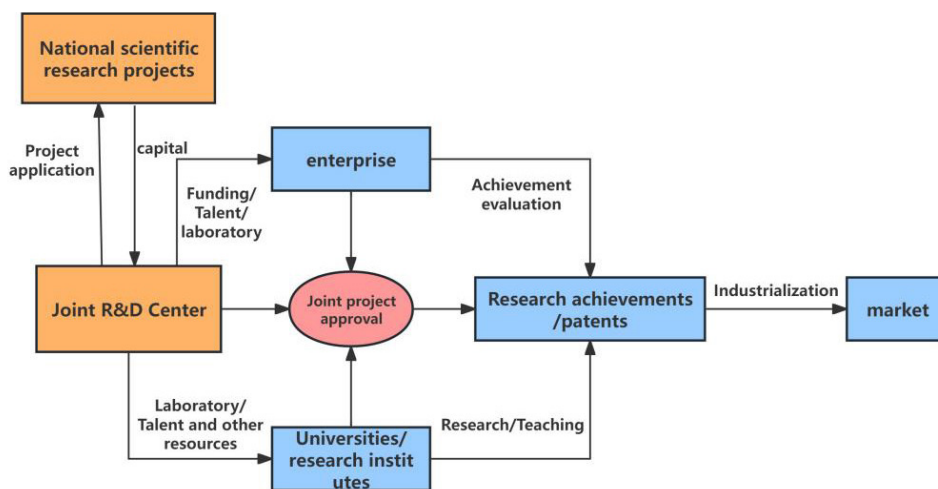


Figure 2. Operation flow of industry-university-research cooperation base

Secondly, according to the major setting and training program of transportation, a questionnaire survey is conducted on the needs of graduate students in practice and experiment. The training needs are classified according to the investigation and analysis results, and various needs are forecasted by combining qualitative and quantitative methods. Finally, it analyzes the development pattern of the graduate training mode, determines the evaluation index of the training mode effect, and puts forward the evaluation method of the operation effect of the graduate training model, which provides a theoretical basis for the improvement of the training mode.

4.2. Strengthen school-enterprise cooperation to cultivate outstanding talents

First of all, investigate the main business types of the cooperative units, analyze the research scope and requirements of various production practice projects, and reveal the needs of the cooperative units for the technical and theoretical basis of graduate students engaged in various production practice projects, to put forward specific requirements for the construction of transportation graduate training mode. Secondly, the practice conditions of graduate students in cooperative units are investigated, and the evaluation index system of practice conditions of cooperative units is established, including scientific research, production projects, published papers and patents, rewards for achievements, and so on. Expert scoring methods can be used to comprehensively evaluate the practice conditions of cooperative units. Finally, the demand of graduate students for practice and experiment and the demand for cooperative units in terms of technology and theory can be predicted respectively. Quantitative and qualitative methods can be used to not only provide data support for the construction of production, university, and research training platforms but also reflect the development goals of higher education quality, and follow and reflect the patterns of education and teaching. It can guide the further improvement of the training program for outstanding talents.

5. Summary and prospect

The combination of industry and university is a commonly used teaching mode in higher education in the form of modern economic and social development. By combining the characteristics of transportation, this paper carries out research from the current situation, benefits, and ideas of the combination of industry, university, and research, focusing on the training objectives, training methods, and training quality of graduate students, and formulating a talent training plan that conforms to the development of transportation majors. This can perfect the innovative curriculum system, build the teaching platform of production, university, and research, further optimize the teaching method and evaluation mode, and provide useful research results and value for universities.

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