

Discussion on the Individualized Talent Cultivation Mode of the Urban Rail Transit Operation and Management of Emerging Engineering Education

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Abstract—In order to cultivate advanced applied talents in urban rail transit management and R&D department, the individualized personnel cultivation mode is an important measure. In view of the problems existing in the talent cultivation of communication and transportation major (rail transit operation and management), the framework of individualized talent cultivation was put forward under the emerging engineering education. The corresponding matrix of the graduation requirements and knowledge, ability and quality was also planned, thereby curriculum system was set and the individualized evaluation system was constructed in the process of implementation. The solutions developed have been carried out and is to be verified in future teaching practice in order to constantly improve the individualized talent cultivation mode.

Keywords—Urban rail transit; Operation management; Individualized talents; Cultivation mode

I. INTRODUCTION

In 2017, the colleges and universities in China kicked off the construction of "emerging engineering education", and the cultivation of "emerging engineering education" talents that adapt to the social development demands is the top priority of construction. However, each college and university has formed its own unique educational resources and the differences in student sources, therefore, how to cultivation individualized talents has become the focus of attention of our society. Urban rail transit is an emerging mode of transportation that is generated in response to the demands of urban development, and it is urgent to provide talents that are compatible with it, among which, the cultivation of talents in the direction of urban rail transit operation and management has received more and more attention.

In terms of the methods and concepts of individualized talent cultivation in colleges and universities, many researches have been carried out in the colleges and universities in China. JIANG Hui et al. [1] put forward several measures to build the individualized innovation and entrepreneurial talent cultivation mode in colleges and universities; FENG Xiaoli [2] analyzed the role of active practice teaching in the cultivation of individualized talents and pointed out the path of implementation; DENG Keying et al. [3] summarized the successful experience of individualized talent cultivation at the University of Maryland, USA, and explained what could be learned by Chinese colleges and universities; ZHANG Sheng et al. [4] analyzed the individualized talent cultivation mode of

the colleges and universities in New Zealand, and put forward some suggestions for the cultivation of talents in colleges and universities in China; LI Zhihai et al. [5] and PANG Guibo et al. [6] discussed the reform measures under the cultivation mode of individualized talents for emerging engineering education respectively, and put it into practice.

The above researches on the cultivation of individualized talents at home and abroad has certain reference value for the construction of "emerging engineering education" in China's colleges and universities, this paper will explore the concepts and methods of results-oriented individualized talent cultivation mode in the direction of urban rail transit operation and management towards the development demands of communication and transportation in the cities on the west bank and with the construction of emerging engineering education as the opportunity, and carry out some researches on talent graduation requirements, curriculum system setting, teaching evaluation system, etc.

II. EXISTING PROBLEMS

The professional talents required for urban rail transit mainly come from the two majors, i.e. communication and transportation and traffic engineering. Xiamen University of Technology established the communication and transportation major (rail transit operation and management direction) in 2012 in response to the demands of urban rail transit construction in Xiamen City Special Economic Zone after approved by the Education Department of Fujian Province. However, due to the influence of various factors, there are the following four aspects in the cultivation of individualized talents in this major:

A. *The individuation in terms of rail transit operation and management talent cultivation objective is reflected insufficiently*

Because of very few teachers in the professional faculties who graduated from the communication and transportation major and lacked comprehensive grasping of the major system, the unclear major orientation and vague cultivation objective understanding are resulted, especially the awareness of the individuation cultivation is insufficient and there are many difficulties in the condensation of major characteristics, thus, the overall grasping of the individualized talent cultivation scheme is not accurate.

B. The standards of individuation cultivation are not clear and the integrity and systematicness of the curriculum system is weak

The integrity and systematicness of the set curriculum system has been weak for a long time due to relatively vague expression of partial individuation cultivation objectives and cultivation specifications and weak pertinence resulted from inevitable indiscriminate imitation traces because of the fewer and unspecific individuation cultivation standards related to this major and the general adoption of analogy or transplantation method in the formulation of talent cultivation scheme.

C. The individualization effect of students' comprehensive ability, quality and knowledge structure is not good

Because the graduation requirements of this major are weakly related to the students' quality, ability and knowledge, and their specific ability, quality and knowledge descriptions are more abstract, the expressions of the ability to solve complex engineering problems and the innovation ability are weaker, especially there are many problems in the individualization expressed in terms of achievement paths or links, which makes it difficult for the cultivation effect of students to achieve the expected results of the major cultivation scheme.

D. The quantitative analysis of various projects during the process of the individuation cultivation is insufficient

In the past, there were so many subjective or qualitative evaluations in the evaluation process of graduates, cultivation objectives, curriculum systems and course contents, which directly led to difficulties and even errors in decision-making by teachers and managers. In addition, the evaluation of the above indicators is the evaluation value obtained by weighting various factors, however, most weights are set subjectively and artificially, which is short of a certain scientific evidence.

The innovative talents must be cultivated from innovations in ideology innovation, teaching content innovation, teaching environment innovation, achievement evaluation, etc., to form

an effective operation mode for sustainable development of innovative talent cultivation. In view of the above problems, the paper plans to carry out researches and explore solutions in the following aspects.

III. COUNTERMEASURES FOR INDIVIDUALIZED TALENT CULTIVATION

A. Building the framework for individualized talent cultivation

It is necessary to analyze the connotation of the emerging engineering education construction from the school's concept of running a school and the orientation of running a school, gradually build the concepts and principles of the talent cultivation mode based on the individualization of emerging engineering education in terms of engineering education according to the demands of the society for professional talents in rail transit, research the individualized talent cultivation laws under emerging engineering education and explore the fundamental theory or practical basis for the implementation of the project; analyze the general standards and national standards professionally certified by the communication and transportation major, and achieve professional and accurate positioning around the communication and transportation major (direction of rail transit operation and management), and complete the formulation of individualized talent cultivation objectives for emerging engineering education; design the individualized matrix of graduation requirements and students' ability, quality and knowledge in detail, analyze the supplementary standards certified by engineering education of the communication and transportation major, set up the individualized curriculum system, and then research the individualized talent cultivation objectives, cultivation standards, implementation links or paths and curriculum weighting evaluation method; formulate the humanities-oriented rail transit operation and management talent cultivation scheme for the emerging engineering education finally, and pass the empirical research. The specific research ideas are shown in Figure 1.

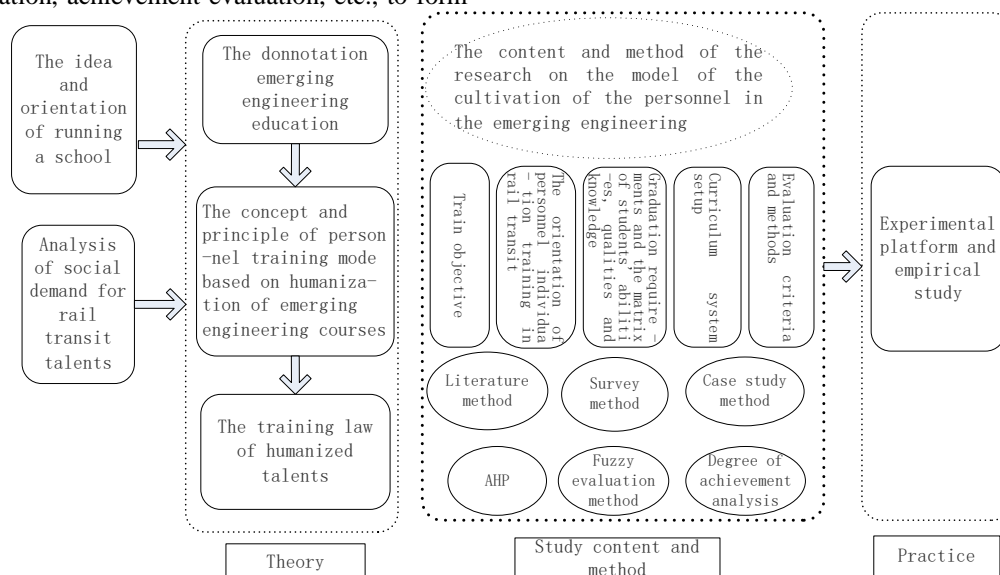


Fig. 1 Project research ideas

B. Building the individualized matrix of the graduation requirements and abilities, qualities and knowledge

It is necessary to plan the graduation requirements firstly in the individualized talent cultivation scheme of rail transit operation and management according to the general standards and supplementary standards certified by engineering education of the communication and transportation major, such as the ability to apply mathematics, natural science, engineering foundation and professional knowledge in solving complex engineering problems in terms of communication and transportation major; have the ability to apply the basic principles of mathematics, natural sciences and engineering science and identify, express, analyze and research complex

engineering problems through literatures in terms of communication and transportation major to obtain effective conclusions... Design the corresponding knowledge, ability and quality under each graduation requirement (as shown in Table 1) secondly, such as having a more solid foundation in mathematics and other relevant natural science knowledge; Master basic theories and knowledge, such as operational research, management science, communication and transportation organization science. Improve the matrix of graduation requirements and ability, quality and knowledge continuously based on the above points in future teaching practices.

TABLE I GRADUATION REQUIREMENTS AND KNOWLEDGE, ABILITY AND QUALITY

Graduation requirements	Knowledge, ability and quality
1. Engineering knowledge: Have an ability to apply mathematics, natural sciences, engineering foundation and expertise in solving complex engineering problems in terms of transportation engineering major.	Have a more solid foundation in mathematics and other related natural sciences. Understand the mechanics, electrical engineering, electronics and other related knowledge. Master basic theories and knowledge, such as operational research, management science, communication and transportation organization science. Learn the thinking method of analyzing and solving problems with computer and master the basic programming method. Have the ability to apply the basic concepts of mathematics and natural science in the representation of engineering problems (systems or processes) and establish the correct mathematical models.
2. Problem analysis Have the ability to apply the basic principles of mathematics, natural sciences and engineering science and identify, express, analyze and research complex engineering problems through literatures in terms of transportation engineering major to obtain effective conclusions.	Have the ability to apply theories and methods of the mathematics and other related natural sciences in analyzing and solving engineering practice problems. Master the general optimization methods and basic techniques of computer application in communication and transportation. Have the ability to solve real problems with a computer. Have the ability to apply standards, specifications and access to technical data. Master the basic methods of literature search, data query and information acquisition with modern information technology. Master the basic theories and methods of urban rail transit operation and management. Have multi-disciplinary diversified knowledge structure such as drawing, engineering mechanics, electronics and computer.
3. Design/development solution: Have the ability to design solutions for complex engineering problems in terms of transportation engineering, design communication and transportation systems, units (parts) or processes that meet specific demands, and have the ability to reflect innovation awareness in the design process and consider society, health, safety, law, culture, environment and other factors.	Have the ability to express, analyze and solve the practical problems of rail transit operation and management with the basic theory of communication and transportation engineering. Understand the important legal, regulatory, social, economic, and management elements involved in communication and transportation-related production, design, research and development activities, and understand their objectives, policies, and regulations. Have the hands-on practical skills and comprehensive experimental skills during basic experiments in science and engineering. Have the initial ability to engage in scientific research and technology development in the field of communication and transportation.

C. Setting up the individualized curriculum system

It is necessary to set up the corresponding curriculum system following the above constructed individualized matrix of graduation requirements and ability, quality and knowledge and achieve the ability, quality and knowledge through the teaching of specific courses; plan to adopt the communication and transportation regulations and policies, operational research, management science, urban rail transit planning and design, introduction to rail transit, communication and transportation equipment, transportation safety, transportation business, transportation economics, transportation port and hub design, management information system and other courses as the core courses of this major from the cultivation objectives of this major based on the supplementary standards certified by engineering education of the communication and transportation major and its national standards of teaching quality in the planning of the curriculum system; Then plan a number of

course modules (theoretical course and practical course links) for the individualized talent cultivation of urban rail transit operation and management in combination with the individualized talent cultivation objectives of emerging engineering education; put focus on studying and setting multiple optional curriculum modules in individualized development direction in combination with the objective of individualized talent cultivation to meet the demands of students' individuation development, and set a number of individuation cultivation modules in such directions as urban rail transit passenger flow analysis, road network planning and design, operation, management and control, emergency response.

D. Establishing the diversified evaluation system for all aspects during the whole process of individualized talent cultivation

It is extremely important to monitor the course teaching quality and establish the evaluation system of each link in the individualized talent cultivation scheme in order to dynamically adjust the cultivation objectives and the matrix of graduation requirements and ability, quality and knowledge. It is necessary to create a cultivation objective - graduation requirements and indicators - curriculum matrix structure, use the analytic hierarchy process to determine the weight of the evaluated project, and use fuzzy theory to quantitatively evaluate all aspects of the teaching process; construct a "trinity" evaluation subject composed of colleges and universities, employers and students, and create a web-based teaching quality or cultivation quality information platform around the teaching effect and graduate student cultivation quality during the teaching process;

pay attention to the evaluation of students' individualized ability and establish a flexible and diverse evaluation mechanism according to the characteristics of the communication and transportation industry and the major; and put focus on students' ability to analyze problems and solve problems manually in practical teaching; In addition to practice and experimental reports, it is also necessary to gradually establish evaluation standards based on project implementation process control and completion effects, emphasize the coordination among various departments, communication between superiors and subordinates, overall planning, response under emergency, teamwork, language and writing ability, etc. in the comprehensive quality evaluation, and simultaneously pay attention to the evaluation on language civilization, behavioral norms, instrument etiquette, self-discipline, etc.

E. Other aspects

At the beginning of entrance to the university, attention should be paid to students' vision design and employment guidance. To this end, special attention must be paid to the teaching of the curriculum of Introduction to Professional Course and Guidance to Learning Career Planning. The students should clear their own career goals through learning this course, determine the studying and striving direction during the university, so that they can fully consider their future employment direction when choosing an elective course. The students are required to pay close attention to the national economic situation and policy development trends, understand the employment situations and development spaces at home and abroad, and adjust relevant courses properly with social employment as orientation during study in the university.

The colleges and universities should reform the teaching of practical courses and establish an incentive mechanism to guide students to carry out initiative practice. The active practice teaching can enable students to lay a good theoretical foundation through "replication experiment", inspiring students' innovative thinking through "designing experiment" and improve students' individualized innovation ability through "comprehensive experiment". For example, the practice method of practice courses should be changed from concentrated practice, and different time frames and places

should be consciously chosen for decentralized practice; The themes, contents and methods of the decentralized practice should be proposed by the students or study groups and determined after revised and improved by the teachers; In the process of practice, the teaching activities should be carried out closely around strengthening students' applied mathematics model, big data analysis, operation principle and other knowledge, abilities and qualities.

The utilization of existing resources and the development extent of potential resources should be increased, for example, in terms of the school's graduate resources, it is urgent to establish a contact channel for employment, and use graduates to establish and improve the channels of information exchange between employers and their alma mater to learn more about the demands of the industry for talent individualization. The colleges and universities should also invite graduates to return to their alma mater to conduct analysis and discussion on the implementation effects/outcomes and typical cases of this major from time to time, introduce the latest achievements, technologies and methods of the industry when the conditions are allowable, and supplement or update existing teaching content in the form of supplementary materials so as to form an environment conducive to the cultivation of individualized innovative talents.

IV. PRACTICING SOLUTIONS

The individualized talent cultivation scheme formulated has been implemented in the 2018 communication and transportation major (rail transit operation and management); The diversified evaluation system of the initially constructed individualized talent cultivation process is gradually being applied or tested; The syllabus for each course is being formulated or perfected. At present, the communication and transportation major (rail transit operation and management) has been approved as a school-level special project of local characteristics in our university and the project team will focus on strengthening the construction of the practice base, graduate resources and evaluation system platform during construction. In a word, the above formulated countermeasures has been implemented in this major to verify the feasibility and correctness of the scheme.

V. CONCLUSION

It is necessary to carry out the individualized teaching and grading management effectively with students as the center according to the individual characteristics of the students, forge ahead with determination, be brave in innovation and constantly explore the cultivation mode of individualized talents under the background of emerging engineering education in communication and transportation major (rail transit operation and management), continuously improve the individualized talent cultivation mode guided by the learning outcomes of students, as well as take the opportunity of emerging engineering education construction as an opportunity to promote the continuous improvement of students' comprehensive knowledge, quality and ability.

ACKNOWLEDGMENT

The authors would like to acknowledge the financial support from Emerging Engineering Research and Practice Project of Xiamen University of Technology (grant No. XGK201709), The Teaching Reform and Construction Project of the Education of Xiamen University of Technology (grant No. JGY201604).

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