

Research on the Practical Path of Digital Transformation and Upgrading of Urban Rail Transit Major

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Abstract: Vocational colleges are facing critical challenges in professional upgrading and digital transformation in respond to meet the advancement of society and self-development, driven by the demand for external digital talent and the need to improve education quality. This program aims at the on-going digital transformation of the urban rail transit major, analysing its connotation, characteristics, challenges encountered, and the implementation approach, and performs a comprehensive evaluation to promote its upgrading. By enhancing the talent training quality and innovation levels, this study provides a reference basis for the digital transformation of vocational college specialties, specifically in urban rail transit, to meet the emerging demands of society.

1. Introduction

For the past few years, China's urban rail transit has been making strides towards becoming smarter and more intelligent. The rail transit industry is driven by digital technology, which creates massive demands for workforce of professionals with complex advanced skills in computer networks, information data technology, and other related areas. Consequently, the rail transit universities and colleges are required to conduct a systemic transformation in the talent cultivation concept and teaching methods, with a simultaneous shift towards digitization in vocational education. The focus of this paper is mainly to provide the urban rail transit major a systematic analysis of the digital transformation, which may hopefully offer valuable experience for the digital transformation of vocational education in China.

2. Current Situation, Significance and Value of Research at Home and Abroad

2.1 Research Status at Home and Abroad

The *2021-2027 Digital Education Action Plan* released by the European Union on September 30, 2020, clarifies two strategies for digital education: firstly, to promote the development of high-level digital education ecosystems and secondly, to strengthen digital skills and literacy to adapt to digital transformation[1]. In 2022, the *Key Points for Vocational Education and Continuing Education Work in 2022* released by the Department of Vocational Education and Adult Education of the Ministry of Education further advocates the digital transformation of vocational education and continuing education[2]. As one of the important issues in the high-quality development of vocational education in the new era, the digital transformation of vocational colleges has been studied by many scholars. For instance, Zhang Qingshan (2021), by describing the background as well as the trends of digital empowerment education, proposed the key control points and effectiveness characterization for high-quality development of empowered vocational education[3]. Li He (2020) summarized the practical experience and common characteristics of digital campus construction in vocational colleges and put forward optimization strategies for existing problems.

2.2 Research Significance and Value

Currently, studies of the digital transformation of vocational education tend to concentrate on the macro-level[4], covering topics such as background, challenges, and development strategies. However, a systematic case study of digital transformation in vocational colleges is absent, and an established research system is yet to be developed. This paper provides a systematic analysis of the digital transformation of the urban rail transit major, covering its connotation, current issues, implementation strategies, and comprehensive evaluation. The aim of this research is to upgrade professions related to rail transit, enhance the quality and innovation of talent training, and provide practical guidance for the digital transformation of vocational education.

3. The Connotation and Characteristics of Digital Transformation of Vocational Education Majors

(1) Connotation of digital transformation of vocational education majors

The digital transformation of vocational college majors has emerged as a new trend in the field of vocational education under the background of Digit Era[5]. The digital transformation of vocational education majors encompasses the deep integration of applying the digital technology and the educational and teaching practices. Further, it also entails establishing interconnected relationships between schools and schools, schools and society, schools and enterprises for resource sharing. The transformation enhances education content, learning style, teacher roles, and assessment methods, as well as other aspects of the major, to provide more free, comprehensive, and personalized learning experiences. Consequently, it establishes a more open and flexible education system and promotes the improvement of the quality of digital talent cultivation.

(2) Characteristics of digital transformation of vocational education majors

The utility of digital technology allows the swift collection of the requirement of the enterprises and society for talents, enabling vocational education to respond promptly through adaption in major setup, educational goals, curriculum development, and other teaching activities[6]. In addition to traditional classroom instruction, learners can also access a wide range of informational resources such as databases and digital platforms, providing the opportunity for continuous, comprehensive, and personalized learning. This approach fosters a more open studying method, enhancing the adaptability of vocational education and promoting quality digital talent development.

4. Problems and Challenges of Digital Transformation in Vocational Majors

(1)Over-emphasis on the application of digital technology and neglect of human education development

The current digitization of vocational majors is still largely centered around digital technology[7], using it to enhance the efficiency of teaching activities. However, there is little attention paid to whether it promotes the overall development of individuals. The challenge lies in how to fully utilize digital technology to genuinely achieve the comprehensive development of individuals.

(2)Insufficient teacher practice and weak digital teaching ability

The lack of awareness and skills of teachers in integrating digital technologies into teaching[8] has hindered the smooth progress of digital transformation. To promote the digital teaching ability of our teachers, it is necessary to provide training programs to improve the skills of teachers in digital teaching.

(3)Insufficient data resources to satisfy digital teaching needs

Due to insufficient funding, local vocational colleges have difficulty in establishing high-level data libraries and resource pools, moreover, loosening the interactive ties with the society and business[9]. This inadequacy of data resources restricts access to learning resources and impedes the progress of digital transformation.

(4)Lack of standardized digital teaching management system

Presently, management still relies on traditional teaching methods[10], thus fail to monitor and

amend the teaching activities, which subsequently lead to ineffective communication, delayed feedback and the lack of standardized digital teaching practices. Having standardized teaching management and decision-making processes are essential to ensure that digital transformation progresses smoothly.

5. The Implementation Path Followed by the Digital Transformation in Urban Rail Transit Major

The implementation path of digital transformation in vocational education of urban rail transit major can be divided into five chapters: digital data platform construction, digitization of training infrastructure development, standardization of the digital management system, digital transformation of teaching methods, materials, and faculty, and digital transformation of the industry-education integration.

5.1. Establishment of an Interoperable Digital Data Platform

An open “smart classroom” for urban rail transit has been constructed by leveraging the open vocational education platform in the urban rail transit sector. To enhance resource sharing among vocational institutions, a virtual simulation training resource sharing platform has also been co-built. Teaching resources can be uploaded to the platform, allowing smooth sharing across institutions. Additionally, a “big data resource center” has been established in collaboration with industry experts and is seamlessly integrated with industrial enterprises. The center supports data platforms for “training, teaching, experience, sharing, and research”, thereby facilitating various aspects of vocational education[11]. Teaching resources from rail transit institutions, on-site resources from rail transit enterprises, the latest industry information and national policies are integrated into this data platform, with live update service. As a result, learners have continuous access to latest knowledge.

5.2. Development of Infrastructure for Digital Training

Advanced digital training bases have been established by vocational colleges to help students in urban rail transit major develop both professional knowledge and practical skills. In alignment with the industry’s trends, these training bases provide a platform that integrates teaching, practical training, and scientific research, allowing students to deepen their theoretical understanding and improve their practical ability. Digital simulation driving platforms, such as the one implemented for urban rail transit major, enable students to simulate the operation of urban rail transit vehicles and address faults that may arise during operation, which improve students’ practical ability and makes them more suitable for the employment requirements of enterprises[12]. Other digital training systems, like the “urban rail transit digital monitoring training system” and “urban rail transit vehicle digital control system”, are also utilized. This comprehensive structure guarantees that students are better prepared for employment in the transit industry.

5.3. Improvement of Standardized Digital Management System

A complete digital management system enhances the professionalism and standardization of vocational education during its digital transformation. Professional managers need to base their decision making on digital teaching data, combine their professional knowledge and practical experience, and utilize big data systems to acquire teaching information and monitor teaching processes dynamically. This ensures that the management system can be adjusted promptly and achieves scientifically and systematically standardized management.

5.4. Digital Transformation of Teaching Methods, Materials, and Faculty

The development of double professionally titled teachers in urban rail transit major is facilitated through digital training, which enhances their competencies in this field and allows the sharing of professional teachers and resources among colleges offering urban rail transit programs. To improve their digital education and teaching ability, teachers need to reform their pedagogical approaches, build digital thinking models, and integrate digital resources. Digital standards are utilized to

transform urban rail transit professional courses, and new forms of digital textbooks and teaching resources are constantly developed, with timely updates based on the digital demands of urban rail transit jobs. The teaching method for urban rail transit major should also reflect the use of digital teaching content and job requirements, with teaching objectives integrated into urban rail transit professional digital standards and teaching processes reflecting digital production processes.

5.5. Digital Transformation of the Integration of Vocational Education with Industry

Collaboration between vocational colleges and urban rail transit enterprises, such as Wuhan Metro Company, CRRC Zhuzhou Electric Locomotive Company, and Wuhan Railway Bureau Company, is established to make timely adjustments to talent development plans and professional course standards based on the digital talent needs of enterprises. The integration of vocational education with industry between colleges and enterprises is advanced in the digital domain through the construction of a shared data platform.

In the digital transformation of urban rail transit major, colleges and enterprises should utilize a data platform to share digital courses, teaching resources, facilities, services, and other resources, establishing a modular and progressive course system to provide personalized teaching content for learners based on their needs. The professional digital education system provides a more comprehensive education package, including knowledge and skills training, teacher development, management services, and a teaching evaluation system, overcoming the constraints of time, space, and location for learners, who can obtain new skills, knowledge, and new creative solutions anytime and anywhere to achieve their lifelong learning goals.

6. Comprehensive Evaluation of Digital Transformation of Urban Rail Transit Major

Table 1 Adjustment of program content of urban rail transit courses

Courses	Adjustment of program content
Urban Rail Transit Signaling and Safety Equipment	Capable of manipulating a train in response to signal display requirements, and proficiently driving a train in ATC mode using a digital simulation training platform.
Introduction to Urban Rail Transit	Mastery of the power supply system, traction system, station management, vehicle system, etc., and the ability to use big data centers to understand the current status of urban rail transit development and develop a comprehensive understanding of urban rail transit systems.
Urban Rail Transit Vehicle Braking	Ability to master the structure and maintenance of the air brake and independently operate and maintain it through digital simulation training platforms
Control of Urban Rail Transit Vehicles	Ability to master the inspection and maintenance of the urban rail transit vehicle control system and troubleshoot control circuit faults using a digital simulation system.
Air Conditioning for Urban Rail Transit Vehicles	Ability to master the basics of urban rail vehicle air conditioning, the composition of air conditioning systems, and their working principles, and operate and perform routine checks on passenger car air conditioning refrigeration systems using digital simulation platforms, including judging and dealing with common faults.

The purpose of the comprehensive evaluation is to determine the success and professional advancement achieved through the digital transformation of the urban rail transit major. The comprehensive evaluation includes an assessment of various aspects of the urban rail transit major, such as the restructuring of professional talent training programs to meet current digital talent demand, the effectiveness of integrating production and education to achieve a mutually beneficial outcome

for enterprises, colleges, students, and society, students' performance in skills competitions, the ability of newly recruited students to meet the needs of enterprises, students' access to self-learning opportunities through data platforms, and the improvement of teaching quality in the urban rail transit profession.

Firstly, adjustments have been made to the content of urban rail transit talent cultivation programs by incorporating digital elements into the courses, as shown in Table 1.

Secondly, collaborations with multiple rail transit companies such as Wuhan Metro were established through the signing of order-based classes and the development of off-campus training bases, with resource sharing achieved through a data platform. As a result, the practical skills and professional qualities of the students have significantly improved, with satisfaction ratings from companies such as Wuhan Metro reaching over 98%. Additionally, the use of digital training platforms has enhanced students' interest in learning, which has led to their excellent results in the national rail transit skills competition, with one team winning the second prize. Finally, as shown in Table 2, it is clear that the students' academic performance has significantly improved, their satisfaction with the teaching methods has increased, and their ability of self-learning through digital platforms has significantly strengthened.

Table 2 Questionnaire of students' performance, satisfaction and degree of self-learning of knowledge

Statistical data source	Final performance average	Satisfaction with teaching	Degree of self-learning of knowledge
Before digital transformation	75.2	70%	40%
After digital transformation	82.3	95%	90%

7. Conclusion

Digital transformation is a significant conduit and pathway for the reform of vocational education. This paper provides a systematic analysis of the connotation, problems encountered, implementation path, and comprehensive evaluation of the digital transformation of urban rail transit major. The research shows that students are able to independently obtain the necessary knowledge and abilities and improve their digital skills, resulting in a significant enhancement of the quality of talent cultivation. The digital upgrade of the urban rail transit industry is also promoted, thus improving the quality and innovative level of professional talent cultivation and providing a reference basis for the digital transformation of vocational education.

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