

Research on the Integrated Development of Industry and Education Driven by Digital Technology in Higher Vocational Colleges

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Abstract: The integration of industry and education is an important school-running mode for higher vocational colleges to fulfill the educational mission of vocational education and meet the talent demands of industries, and it also serves as the major starting point for the high-quality development of vocational education. With the comprehensive popularization of digital education, digital technologies such as big data and artificial intelligence as well as virtual reality have injected new vitality into the reform and innovation of industry-education integration in higher vocational colleges, breaking the time and space restrictions and resource barriers, and making up for the shortcomings in cooperation of traditional industry-education integration modes. This paper systematically analyzes the current status of industry-education integration in higher vocational colleges, explores the teaching value and educational significance of digital technologies empowering industry-education integration, and conducts an in-depth analysis of practical paths for digital technologies to boost the high-quality development of industry-education integration from multiple perspectives. This study is expected to provide new ideas for higher vocational colleges to optimize the industry-education teaching system through digital reform, improve the quality of technical and skilled talent training, and promote the coordinated development of education and industries.

Keywords: Digital technology; Higher vocational colleges; Integration of industry and education

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1. Introduction

As an important component of the national education system and human resource development, vocational education undertakes critical tasks including cultivating high-quality technical and skilled talents, inheriting technical skills, and boosting employment and entrepreneurship. Centered on serving industrial development and matching post requirements, higher vocational colleges take industry-education integration and school-enterprise cooperation as their core school-running characteristics that distinguish them from general higher education. They are also the core path to improve teaching effectiveness, meet industrial demands and guarantee talent training quality. With the rapid growth of the digital economy, the digital transformation of all

industries is accelerating, bringing fundamental changes to post technical standards, skill requirements and working modes, and imposing new demands on teaching modes, practical training systems and educational mechanisms of talent cultivation in higher vocational colleges. The widespread penetration of digital technologies creates new opportunities for teaching reform and the upgrading of industry-education integration in vocational education, and effectively breaks the barriers between campus teaching and enterprise production as well as industrial development, so as to effectively improve students' comprehensive literacy.

2. Current situation of industry-education integration in higher vocational colleges

At present, all colleges take school-enterprise cooperation and industry-education coordination as key tasks of teaching reform, and have initially formed a talent training system characterized by school-based education and enterprise empowerment guided by industries. A large number of industry-education integration practices have been carried out in specialty construction, practical teaching, student internships and employment, and the overall pattern of industry-education integration in vocational education has basically taken shape. Nevertheless, viewed from the perspective of digital transformation and high-quality talent cultivation, there still exist several problems in the practical teaching of industry-education integration in current higher vocational colleges, which will diminish the overall educational effectiveness to a certain extent ^[1].

First, the degree of digitalization of traditional industry-education integration teaching modes is relatively low. Most school-enterprise cooperation still relies on offline face-to-face communication, traditional classroom teaching and fixed training venues, lacking the application of digital teaching tools, virtual training platforms and online collaborative education systems. Meanwhile, campus teaching resources and enterprise digital production resources cannot be shared, which easily leads to the updating of teaching contents lagging behind enterprise technological iteration, and students' knowledge and skills being disconnected from digital post demands ^[2].

Second, the school-enterprise collaborative teaching mechanism is imperfect. The industry-education integration of most colleges only stays at shallow levels such as internships and joint base construction. Enterprises lack enthusiasm to participate in the whole talent training process, and have not truly integrated into core teaching segments including curriculum development, teaching design, practical training assessment and teacher training, with unclear division of educational responsibilities between schools and enterprises ^[3].

Third, the evaluation system of industry-education integration teaching is relatively simple. Most colleges still take classroom examinations and final theoretical tests as major evaluation means, without constructing a comprehensive evaluation system combining enterprise digital skill standards, practical operation abilities and professional literacy. As a result, the overall evaluation results fail to reach expected teaching objectives ^[4].

3. Teaching significance of digital technologies driving the development of industry-education integration in higher vocational colleges

3.1. Enrich teaching resource system and break barriers of traditional teaching resources

Digital technologies feature resource integration, cloud sharing and real-time updating, which can fundamentally break the resource restrictions of traditional industry-education integration teaching in higher vocational colleges and fully enrich the vocational education resource system. The traditional teaching resources of higher vocational colleges mainly rely on campus textbooks, offline training equipment and

on-campus teachers, with problems such as limited total quantity, slow updating and low degree of industry matching, which easily prevent overall teaching from adapting to the rapid iteration of industrial technologies ^[5]. High-quality enterprise production resources, post-operation resources, and cutting-edge industrial case resources are restricted by time, space, permissions and media, and cannot be converted into teaching resources, easily causing an imbalance between supply and demand of industry-education teaching resources. Meanwhile, digital technologies can help teachers build cloud resource sharing platforms, so as to effectively break resource barriers between schools and enterprises. Enterprises can upload digital production processes, post-operation standards, cutting-edge technical cases, and practical project materials to the sharing platform. Colleges can select, sort out and optimize various industrial resources according to teaching needs, and turn them into digital curriculum resources, virtual teaching materials and project teaching cases that meet the demands of classroom and practical training teaching ^[6]. In addition, teachers can update teaching content in a timely manner via digital resource platforms, integrate the latest industrial technologies, processes and job standards into daily teaching, and make classroom and practical training teaching always keep pace with the digital development trend of industries, so as to fully consolidate the resource foundation of industry-education integration and enhance the professionalism, cutting-edge nature and practicality of vocational education teaching.

3.2. Innovate educational modes and improve the effectiveness of talent cultivation

Digital technologies restructure teaching scenarios, teaching methods and learning modes in higher vocational colleges, transforming the single “classroom lecture + offline practical training” industry-education integration education mode into a diversified mode integrating online and offline learning, virtual and real operation as well as school-enterprise collaborative education, greatly improving the training efficiency of technical and skilled talents. In traditional industry-education integration teaching, practical training has drawbacks including high equipment cost, heavy wear, fixed venues and high-risk operation drills that cannot be carried out. Practical training for some digital and intelligent posts cannot be conducted on campus, leaving students with few practical opportunities and failing to reach expected skill training standards ^[7]. Supported by virtual reality, simulation and artificial intelligence technologies, higher vocational colleges can build virtual simulation practical training platforms to simulate real enterprise digital production scenarios, post operation procedures and project operation environments. Students can conduct repeated practical drills in virtual scenes, breaking the restrictions of venues and equipment and overcoming safety risks in traditional training, and realize all-weather, all-round immersive skill training ^[8]. At the same time, digital technologies support personalized and targeted teaching. By relying on the big data analysis functions of smart teaching platforms, colleges can collect students' classroom learning data, practical operation data and mastery of knowledge real time. Teachers can accurately analyze students' learning weaknesses, skill deficiencies and career development characteristics, and adjust teaching plans and carry out personalized tutoring based on data analysis results, so as to eliminate the drawbacks of homogeneous traditional teaching ^[9].

4. Practical paths for digital technologies to drive the development of industry-education integration in higher vocational colleges

4.1. Build digital teaching resource platforms and construct an industry-education integrated resource system

To promote the upgrading of industry-education integration teaching in higher vocational colleges relying on

digital technologies, colleges first need to build professional and integrated school-enterprise digital teaching resource sharing platforms, integrate high-quality educational resources of schools and enterprises, and construct a dynamically updated, co-constructed and shared industry-education teaching resource system^[10].

On the one hand, based on its own specialties and regional industrial development, the college shall cooperate with partner enterprises to build dedicated digital teaching resource platforms, break resource barriers between schools and enterprises, and streamline the whole process of resource uploading, auditing, sharing and application, so as to realize in-depth integration of campus teaching resources and industrial resources. In terms of resource construction, schools and enterprises shall cooperate. Enterprises sort out industrial resources including cutting-edge technologies, digital post operation procedures, real project cases and industrial technical standards, and convert them into standardized and visualized teaching materials. College teachers screen and optimize enterprise resources combined with talent training programs and curriculum syllabi. Meanwhile, diversified digital resources such as digital courses, virtual training projects, micro-course videos, question banks and project teaching manuals shall be developed to form a digital resource library matching different majors, courses and training segments.

On the other hand, a dynamic updating mechanism for digital resources shall be established^[11]. In accordance with the digital transformation process of industries, colleges need to track enterprise technological updates and teaching reform demands, update and optimize platform resources regularly, and eliminate outdated teaching contents to ensure teaching resources always satisfy industrial demands. Besides, colleges shall strengthen the promotion and application of digital resources, guide teachers to carry out online-offline blended teaching with the resource platform, and encourage students to study digital resources and conduct virtual training in spare time, so as to maximize the educational functions of digital resources^[12].

4.2. Innovate digital integrated teaching modes and optimize the whole-process education system

Supported by digital technologies, higher vocational colleges shall reconstruct classroom teaching, practical training and practical education systems. Teachers shall fully implement blended digital teaching modes based on smart teaching terminals and online platforms. They shall integrate enterprise digital project cases, cutting-edge industrial technologies, and post-operation standards into classroom lectures, breaking the traditional cramming teaching mode. Meanwhile, teachers release preview materials, classroom tasks and extension materials via online platforms, and carry out classroom Q&A and group discussions relying on big data interactive functions to strengthen classroom interaction and effectiveness, and closely link theoretical teaching with industrial practice^[13].

In practical training, targeting the shortcomings of traditional training, colleges shall promote the construction of virtual simulation training systems and build virtual training bases together with enterprises. Digital training projects matching real enterprise production scenarios shall be developed to cover high-risk operations, precision technologies and intelligent equipment drills which are hard to implement offline, enabling students to complete full-process operation training in virtual scenes and master operation skills for digital posts proficiently^[14]. Finally, higher vocational colleges can implement a three-stage training mode of virtual training, offline operation and enterprise practice. Basic skills are consolidated via virtual training, operational abilities are strengthened through campus offline drills, and post adaptability is improved with real enterprise projects, forming a progressive practical training education system.

4.3. Construct a digital collaborative education mechanism and improve teaching safeguard systems

A long-term and stable school-enterprise coordination mechanism serves as the core guarantee for the implementation of digital industry-education integration. Higher vocational colleges shall build a digital education mechanism with whole-process school-enterprise collaboration, clear rights and responsibilities and complete supervision supported by digital technologies.

First, a digital school-enterprise collaborative education management platform shall be built, integrating functional modules covering teaching management, joint teacher training, practical training administration, student evaluation and employment matching to realize online coordinated management of school and enterprise teaching work. Enterprises shall participate in core teaching work including specialty construction, curriculum reform, teaching plan formulation and training project design. For example, key technical personnel from enterprises can deliver remote lectures and project comments through the platform; college teachers can learn enterprise digital technologies and post standards via the platform to continuously improve industrial awareness and digital teaching abilities, thus forming a two-way school-enterprise joint teacher training system ^[15].

Second, a diversified digital teaching evaluation system shall be constructed to break the single campus assessment mode and build a comprehensive evaluation system. Teachers can record students' whole-process data including classroom study, virtual training and project practice via digital platforms. Combined with two-way evaluations from college teachers and enterprise tutors, students' knowledge level, practical skills, digital literacy and professional abilities can be evaluated comprehensively and objectively, realizing whole-process, digital and targeted teaching assessment.

Finally, colleges shall improve supporting systems for digital industry-education integration, clarify the rights and obligations of schools and enterprises in digital resource construction, teaching reform, teacher training and student management, and establish regular communication, resource updating and teaching seminar mechanisms to fully enhance the overall effectiveness of industry-education integration teaching.

5. Conclusion

Digital transformation is the general trend of vocational education reform and development in the new era, and also the major driving force for higher vocational colleges to advance industry-education integration. As the primary talent training mode of higher vocational colleges, industry-education integration directly affects the quality of talent cultivation as well as the capacity of vocational education to serve industries. Therefore, the in-depth application of digital technologies can effectively address the pain points of traditional industry-education integration teaching. By integrating high-quality school and enterprise teaching resources and building digital education modes, colleges can enrich all segments of the vocational education teaching system, injecting new impetus into the high-quality development of industry-education integration in higher vocational colleges.

Disclosure statement

The author declares no conflict of interest.

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