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Exploring Strategies for the Development of Digital Textbooks in Vocational Education within the Framework of Urban Industry-Education Integration

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Abstract: *This paper conducts an in-depth investigation into the development of digital textbooks in vocational schools within the context of municipal industrial-education integration. Initially, it examines the implications and significance of constructing digital `textbooks against this backdrop. Subsequently, it identifies existing challenges in the creation of digital textbooks for vocational institutions, including issues related to industry-education integration, construction standards, and institutional mechanisms. Finally, the paper proposes strategies for enhancing digital textbook development in vocational schools and offers recommendations to address these challenges, including seeking policy support, technology, and funding, refining evaluation systems for digital textbooks, and promoting ongoing updates and optimizations.*

Keywords: *Municipal industrial-education integration; Vocational education; development of digital textbooks*

1. Introduction

In January 2019, the People's Republic of China released the "National Plan for Reform and Development of Vocational Education," which emphasized enhancing the synergy between higher vocational institutions and local economic and social development to ensure that vocational education aligns closely with regional economic needs. Moreover, it also stood for the creation of textbooks and teaching resources in the field of vocational education, which can be a supplementary material for educational initiatives. The report from the 20th National Congress of the Communist Party of China outlined a significant strategic initiative aimed at "promoting digitalization in education," wherein the digitization of textbooks and teaching materials represents a crucial aspect of this endeavor. The creation of high-quality digital textbooks is integral to advancing strategic actions that facilitate educational digitalization, explore new developmental avenues, cultivate talents suited for the digital era, and establish an educational powerhouse. At the World Digital Education Conference 2024, the Chinese Minister of Education unveiled the plans to launch an artificial intelligence empowerment system to enable education and technology to work as one. This conference proved to be a landmark for China with its advanced digital textbook construction and cutting-edge teaching reinforced by high-quality content, making this the masterstroke for future research on book publication and distribution in the teaching domain.

The primary objective of this study is to explore the main issues and strategies related to the creation of digital textbooks for vocational schools, particularly in the context of collaborative production and education in urban areas. Finally, the paper attempts to provide creative hints for the deployment of digital textbooks in vocational education.

2. Analysis of the Connotation of Urban Industry-Education Alliance and Digital Textbook Construction

2.1. Analysis of the Connotation of Urban Industry-Education Integration

The urban industry-education alliance is a well-functioning collaboration of industries, educational institutions, and government entities within a city that was formed by the combined forces of enterprises,

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educational institutions, and governmental agencies. It was originally introduced as a suggestion in "Opinions on Deepening Reform of the Modern Vocational Education System," which was released by the General Office of the CPC Central Committee and the General Office of the State Council in December 2022. The main aim of this program is to offer coherent interaction between vocational education and the industrial economy; it covers the basic concepts of talent, innovation, and entrepreneurship as well as the development of high-quality industrial growth. A multi-faceted scheme with diverse stakeholders, governments at the helm, the infrastructure rich in resources, the defining character of possessing a legal entity, and the geographically circumscribed model, its most striking element is this region-specific organization--being the mechanism of creative industry expressions across different territories. The creation of local-level industrial-education partnerships will undoubtedly boost the tight integration of vocational education with local industrial economies by offering strong talent development and intellectual resources, which are vital for economic and social growth.

2.2. Analysis of the Connotation of Digital Textbook Construction

Digital textbooks to date occupy a pretty high position of educational resources that are enhanced through the digital transformation of paper-based materials backed by information technology tools. These tools have interactive features, blur the line between intelligence and richness of media for an enhanced learning experience and are a set of multimedia components such as audio, video images, ANNs virtual simulations, besides electronic texts that are soft too. They also bring with them a variety of teacher resource kits, student performance data, and test platforms. As the extent of digitalization continues to amplify, digital textbooks become essential resources[1-2] in schools. They use the internet tools, the digital media technology[3], the big data analysis[4], and the virtual world technologies[5] to distribute textbook content in an innovative two-fold format both audibly and in three dimensions thus increasing teaching effectiveness and learner experience as well as coordination of individual instruction and evaluation[6]. The digital schoolbooks that are promoted along with the introduction of the intelligent technologies clearly demonstrate the benefits education can derive from the combination of AI developments and teaching staff; besides, they are efficient in the fast reduction of the educational gap in the regional areas of the world and the achievement of educational equity[7].

2.3. Construction of Digital Textbooks in the Context of Urban-level Industry-education Integrated Development

The City-level Industry-education Integrated Development Alliance is one of the most important projects set by the Chinese Ministry of Education to boost the reform of the modern vocational education system. Digital textbooks avowedly are the products emerging from the perfect fusion between information technology ajd education in general be say that they are the ones occupying a central position in the education process with their good features of quality and variance which. First of all, it can be noted that the alliance refers to industrial parks and the leading enterprises ensuring the existence of sufficient industrial resources and practical cases to be used as examples for the creation of digital textbooks. Secondly, the network medium assists education, business, and research platforms in the collaborative creation of digital materials that are recognized according to the existing market requirements. To conclude, members of the alliance both use resource sharing and complementary strengths as well as improve the efficiency and effectiveness of digital textbook development. In conclusion, within the framework established by the City-level Industry-education Integrated Development Alliance, constructing digital textbooks serves as a vital strategy for promoting integration between industry and education while enhancing teaching quality and ensuring educational equity. By reinforcing top-level design principles, cultivating high-quality resources, strengthening teacher training programs, and encouraging widespread adoption, we can significantly elevate both the construction level of digital textbooks and their application effectiveness—thereby providing robust support for reforms in modern vocational education.

3. The Realistic Dilemmas of Digital Textbook Construction in Higher Vocational Colleges under the Background of Urban-level Industry-education Integration

An examination of the literature database from China Knowledge Network (CNKI) focusing on the theme of 'vocational education + digital textbooks' indicates that 80% of articles published post-2020 address this topic, with digital textbooks, vocational education, and new-form textbooks representing 28.71%, 21.78%, and 4.95% respectively. Yang Yuhong et al.[8] initiated their exploration into application

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and development in 2014, followed by Wang Yu, Tang Ming, Zhang Bo, and Feng Chaojun [9-12], who conducted targeted research on the development of digital textbooks under specific conditions. Xu Ye et al.[13-17] investigated the construction and existing challenges associated with vocational digital textbooks. By synthesizing prior research with the current realities faced by regional industrial-education alliances, it becomes evident that higher vocational institutions encounter several dilemmas in constructing effective digital textbooks.

3.1. The integration of Industry-education remains superficial, posing challenges in the selection of textbook content

The municipal industrial-education alliance underscores the necessity for a profound integration of industry and education; however, in practice, achieving this level of integration is often hindered by disparities in objectives, interests, and operational models between the two sectors. This limitation directly impacts the selection and updating of digital textbook content, rendering it challenging for textbooks to fully align with the actual needs of the industry, thereby creating a disconnect between educational materials and practical applications. This issue manifests in several ways: First, while enterprises and schools within the same municipal industrial-education alliance exhibit a one-to-many relationship, the application of identical technologies varies across different enterprises and job roles; second, new technologies and solutions are vital for enterprise survival and growth; thus competition among firms discourages them from sharing cutting-edge energy-efficient technology solutions; finally, under the existing institutional framework, enterprise involvement in digital textbook development increases their workload significantly. Consequently, both industry experts and front-line technical personnel generally show low enthusiasm for participating in school textbook development initiatives. The creation of educational content that abides by both national and regional standards while integrating local specifics needs the participation of teachers who are the main stakeholders in industry activities and the ability to act alone in the process of getting insights. However, this endeavor tends to be prolonged and may lead to self-isolation.

There exist significant disparities in educational philosophies between enterprises and schools. Employee training within enterprises primarily focuses on skill development, where both the training of skills and job requirements are relatively fixed and involve a limited number of individuals. Consequently, enterprises emphasize the cultivation of technical competencies when selecting instructional materials. In contrast, school education targets all students, with a complex and dynamic relationship among students, enterprises, and job demands. Educational institutions advocate for comprehensive student development encompassing moral, intellectual, physical, aesthetic, and labor aspects. Schools prioritize holistic approaches in their selection of teaching materials to cover a broader spectrum of topics. Despite the emergence of numerous textbooks in the context of industrial-educational integration, several issues persist. Some vocational colleges continue to adhere to traditional educational paradigms during digital textbook development processes; others directly adopt enterprise training manuals as instructional resources. Such practices overlook the essential cultivation of students' practical skills, innovative capacities, and overall quality.

3.2. The construction standards remain inadequately defined, and there is a pressing need to enhance the quality of textbooks

Currently, the definitions of concepts and technical standards for digital textbooks remain fragmented. The evolution has progressed from the initial inclusion of CDs with textbooks to the establishment of multimedia teaching websites, followed by the development of course resources leading to 'printed books + QR codes' as a form of digital textbook, ultimately culminating in the era of digital textbook platforms. Throughout this process, the construction of digital resources has predominantly exhibited several key characteristics: First, there has been a strong emphasis on developing multimedia teaching materials such as presentations, animations, and videos. Second, significant efforts have been directed towards creating efficient information platforms that organize and curate diverse scattered teaching resources to facilitate sharing and interactive learning experiences. Third, initiatives promoting digital textbook publishing have aimed at advancing digital publication practices. Fourth, through integrating information technology with hardware tools (such as electronic whiteboards and tablets), there has been an active promotion of digital pedagogy to enhance vocational education classrooms. Nevertheless, several challenges persist.

Firstly, the availability of digital textbooks is limited and their quality is often subpar. On one hand, the costs associated with developing digital textbooks are relatively high; consequently, when many

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schools begin to invest human and financial resources into digital resource development, they typically select only a few representative courses, which fails to provide comprehensive coverage. Paper textbooks remain the preferred choice for most institutions due to their affordability. On the other hand, there exists a notable disparity in understanding digital textbooks among different schools, coupled with significant variability in the expertise of instructors leading these courses, ultimately contributing to lower quality outcomes.

Secondly, both the development and application levels of digital textbooks are inadequate. Most digital textbook initiatives rely heavily on technical support from third-party entities such as publishing houses and educational research organizations. The process of making good digital materials means not only the development of multimedia technology but also the utilization of multimedia tools that are considered to be the most suitable for the transfer of information (and skill) points and hence the students' intuitive understanding and handling of the tasks. However, a smooth workflow between teachers and relevant organizations is the important prerequisite for fooling the creation of quality digital resources; nevertheless, this process is tedious and time-consuming. Additionally, digital textbooks can be put to good use provided that the tutors have high information literacy skills as well as the correct functionality of the hardware and software. Unfortunately, the resources are not often sufficient in the western region schools where the utilization rates are very low.

Finally, digital textbooks are still not able to support resource sharing among students sufficiently. In the first place, each school has specific individual features which lead to different digital textbook offerings among them in their respective regions of polyvalent education associations specifically aimed at the job market which makes the cross-institutional applicability of these subjects even harder and thus, impairs both institutions' collaboration potentialities. Secondly, with the setting where the fabrication of digital resources now involves costs consume enabling schools can acquire the material and they therefore take on the one paying for it, schools supposedly behaving as the entrepreneurs will not open these resources freely. Additionally, in the case of organizations that participate in the development or even distribution of the said resources, the tendency is towards higher pricing which further limits accessibility.

3.3. The institutional and operational frameworks remain inadequately established, resulting in a significant risk of mismanagement and the potential for authority misuse

The overshooting use of technology has trespassed the construction aims initially set. Big data technologies, metaverses, and digital twins are all mentioned in the educational landscape sector, and therefore, their infusion of new technology is all the talk of the town. The fact is, however, that few schools have set up the required systems, standards, and regulations, and this situation has driven them to follow just a flat approach during the implementation of new technologies in the realization stages. This has manifested in the augmentation of the construction costs while at the same time leaving the basic functions of textbooks unaddressed. To some extent, books act as the transporters of knowledge and experience, equally promoting the learners' growth principles as is their role for proper learning delivery. Technology overuse can sometimes form unmapping processes that work against the aim of the program. On the other hand, the high level of technology introduction in new technologies has not only created a higher price for e-textbooks but has also forced schools to decrease their figures.

The variety of different types of content makes the reassurance and monitoring processes more complex. Textbooks are the key to the transfer of knowledge and skills and help the student achieve their life goals, thus they have a moral responsibility toward him as the protagonist of his process. Traditional textbooks are mostly content materials that involve text and images with usually transparent review methods. The publishing houses, on the other hand, are the sole means for the market to enter. In contrast, digital textbooks include not only text and images but also video content, audio elements, and user-generated dynamic models generated by user interaction sessions, along with user profiles—which in general makes the compliance inspection tasks extremely complex in a variety of data types that are found in those resources. Besides, the supervision problems related to the algorithms used during the data generation processes along with the safety management concerns have also become more noticeable. The fact that digital textbooks are transmitted through networks that allow the quick spread of them if any problem arises creates a big influence yet a lot of difficulty with the traceability.

The open nature of application environments makes copyright disputes worse, and that is very much a fact today. Network platforms are used by digital textbooks to enhance presentation with a variety of formats that can facilitate the spreading of information; however, publishers, although using many sophisticated technical means to prohibit unauthorized access and copying of textbook content, artificial

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intelligence has already made substantial progress towards word recognition, image analysis, and video creation to the point that the traditional safeguards are progressively becoming less effective. With that, the imitation and reconstruction of original digital textbook content has dramatically become easier.

4. The Exploration of Digital Textbook Construction in Higher Vocational Colleges from the Perspective of Municipal Industry-Education Consortium

4.1. Define the objectives of curriculum development

The construction of digital textbooks should fully embody the national will and be closely in line with the industrial development demands within the municipal industry-education consortium, the specific role it plays in vocational education, the in-depth understanding of the expected effects, and the precise grasping of the needs of users such as students and teachers. Only by clarifying the goals and positioning can we ensure that the development of digital textbooks is highly consistent with the actual application demands and give full play to their maximum utility.

Firstly, as the main body of digital textbook construction, schools need to conduct top-level design for textbook construction. The design concept should fully implement the national education policy and fully manifest the core socialist values; it should highlight the characteristics of vocational education types and integrate new technologies, new standards, new processes, and new requirements; and it should fully consider the actual situation of the work process.

Secondly, the design of digital textbooks should be in line with students' learning conditions and teaching objectives. Only by being in line with students' learning conditions can the value of the textbooks be fully exerted. Teaching objectives are usually referred to the national vocational technical and skill standards or job competency requirements. Generally speaking, the training of higher vocational students corresponds to the intermediate level (level 4) and advanced level (level 3 or above) of the national vocational technical and skill standards, while that of secondary vocational students corresponds to the primary level (level 5) or intermediate level (level 4).

Finally, based on the actual situation of vocational schools and in combination with the resources and advantages of the industry-education consortium, a scientific and reasonable plan should be carried out. The development plan should be detailed to each link, covering content planning, technical selection, resource integration, production and implementation, and testing and evaluation, to ensure that each step has a clear goal and time node.

4.2. Establish a multi-party collaborative mechanism

In the backdrop of the municipal industry-education consortium, multi-party collaboration is particularly crucial for the construction path of digital textbooks in vocational schools.

Firstly, policy support and financial investment are indispensable and vital for the development of digital textbooks. Government departments should promulgate relevant policies, explicitly expressing support for the development and application of digital textbooks, and constructing a solid policy support for the project. At the same time, through the establishment of special funds and social capital investment guidance, the financial support in digital textbook construction projects should be secured to achieve the project's successful implementation. Besides, educational authorities should spearhead the organization and formulation of the necessary standards and evaluation systems for digital textbook construction.

Secondly, enhancing cooperation with enterprises is also of key significance. Vocational schools should actively seek strategic cooperation with leading enterprises in the industry to jointly develop digital textbooks that align with market demands and industry standards. Enterprises can not only provide financial and technical support for textbook development but also contribute abundant practical cases and industry experience, making the textbook content more closely related to real situations and more valuable in application.

Finally, schools should also formulate systems to motivate teachers to participate in the compilation of digital textbooks. Only when teachers with rich front-line experience are involved can the key points and difficulties in textbook development be better controlled. For instance, how to ensure the timeliness and update frequency of textbook content to adapt to the rapid changes in industry technologies; how to balance the proportion of theory and practice to enable students to master theoretical knowledge and cultivate practical operation abilities during the learning process; and how to design teaching sessions

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rich in interactivity and interest to stimulate students' learning interest and initiative, etc.

4.3. Enhance the technical training for teachers

The construction of digital textbooks demands not only that the textbook compilers be well-versed in the disciplinary knowledge encompassed within the content of the textbooks themselves but also that they know how to present the knowledge more proficiently by means of multimedia technology. This poses an extremely arduous challenge for the planners and compilers of textbooks. Strengthening technical support and training has emerged as an indispensable and crucial aspect.

On one hand, enterprises should be introduced to offer comprehensive technical support to address the technical difficulties encountered during the utilization of digital textbooks. This encompasses numerous issues such as the compatibility of textbook formats, the achievement of interactive functions, and online updates. Through the establishment of a dedicated technical support team or the introduction of third-party service institutions, it can be ensured that teachers and students obtain timely and professional assistance during the usage process.

On the other hand, enhancing teacher training is equally significant. Digital textbooks, in contrast to traditional ones, possess higher interactivity and flexibility but also impose more exacting requirements on teachers' ability to apply information technology. Hence, it is necessary to hold regular training courses for the usage of digital textbooks, facilitating teachers in familiarizing themselves with the functions and characteristics of digital textbooks and mastering effective teaching methods. Simultaneously, by sharing successful cases and teaching experiences, it is possible to stimulate teachers' enthusiasm and innovative spirit in the use of digital textbooks.

4.4. Establish an evaluation and feedback system

The aim of digital textbook construction lies in fully leveraging contemporary information technology to present new knowledge and new skills to readers. Against the backdrop of the municipal industry-education consortium, the construction of digital textbooks in vocational schools not only pertains to the enhancement of educational quality but also constitutes a crucial juncture for facilitating the in-depth integration of industry and education to accommodate the demands of industrial development. To guarantee the quality of digital textbooks, it is indispensable to establish a scientific evaluation system. This system should encompass multiple dimensions such as content accuracy, instructional suitability, technical compatibility, and user experience.

Firstly, an efficient method of collecting teaching feedback needs to be the first point. In this way, the opinions and suggestions of teachers and students will be efficiently collected during the utilization of digital textbooks. Such feedback will be the main part of the textbook optimization process, i.e. it will provide the data and evidence for modification and betterment of the content so as to meet the teaching requirements.

Secondly, it is important to pay close attention to the developments in the industry and the technological dynamics in the market to ensure that digital textbooks are always in line with the changes taking place in the industry. Proactively engaging in partnership and communication with companies is a way to enhance the timeliness of acquiring the latest industry information and technological achievements, thus incorporating them into digital textbooks to boost their relevance and foresight.

Finally, in promoting the constant update and optimization of digital textbooks, the technology of research and development should not be left out. In order to make sure that the usage experience of digital textbooks has been optimized and their interactive and intelligentization level has been increased, there should be ongoing investment in research and development. To continue, big data and artificial intelligence technologies can be used to analyze and predict the students' learning behavior thus offering them more personalized learning resources and tutoring services.

5. Conclusion

The reform of digital textbooks designed in the three-teaching reform is a major part of the process. In the consortium of municipalities between the industry and education sector, it is important to strengthen collaboration and communication among all those involved in production, learning, research, and application, develop together new models for digital textbook construction, and provide a solid ground and strong support for the training of high-quality technical and skilled talents. Apart from being

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the most crucial aspect in the improvement of the quality of school education and the promotion of the close interaction of industry and education, it also has significant importance in the provision of the high-quality development of vocational education.

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