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Research and Practical Exploration of an Integrated Online and Offline Industry-Education Fusion Teaching Model

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Abstract: Promoting the digital transformation of education is a crucial move in implementing the strategies of rejuvenating the country through science and education, building a strong nation through talent, and driving development through innovation. The essence of the educational model for digital innovation and entrepreneurship is the integration of 'theory + practice.' However, practical teaching has consistently been a weak point in various universities, lacking practical guidance from enterprises and high-quality case studies. Therefore, it is necessary to tailor the teaching content based on the characteristics of each major's corresponding industry. This involves making appropriate selections and adjustments, incorporating relevant examples and cases from the professional industry, introducing real-life scenarios from enterprise sites and production lines into classroom teaching. Adjustments should also be made in terms of teaching resources and requirements, integrating industrial elements into the teaching process. Higher education teaching, through the integration of industry and education, deepens cooperation with enterprises, jointly builds curriculum teaching resources to meet the needs of the development of talents in 'new engineering disciplines + new liberal arts disciplines.' This approach aims to satisfy the contemporary and personalized requirements for educational resources.

Keywords: Digitization; Innovation and Entrepreneurship; Integration of Industry and Education; Higher Education Teaching.

1. Introduction

Digital education has become an important force driving global education reform, and promoting the digital transformation of education is an inherent need for high-quality and balanced development of education. Since the outbreak of the COVID-19 epidemic, global education has faced major challenges. The epidemic has triggered unprecedented large-scale online learning, accelerating the process of digital transformation in education [1]. At the United Nations Educational Reform Summit held in September 2022, digital transformation in education was also one of the key areas of discussion among leaders of the summit countries [2]. As a world leader in the internet and digital economy, China also attaches great importance to digital education. The Central Committee of the Communist Party of China has successively issued documents such as the "Ten Year Development Plan for Education Informatization (2011-2020)", "National Informatization Development Strategy Outline", "13th Five Year Plan for National Informatization", "China's Education Modernization 2035", etc., in order to build a digital China and accelerate the transformation of China's digital society[3]. The "14th Five Year Plan for National Informatization" emphasizes the need to "promote educational and teaching reforms that integrate information technology, intelligent technology, and education[4]. General Secretary Xi Jinping emphasized the coordinated innovation of vocational education, higher education, and continuing education, promoting the integration of vocational and general education, industry and education, and science and education, and optimizing the positioning of vocational education types[5].

Digital transformation is driving comprehensive changes in future society. The global digital education revolution has opened up a new path for innovation and entrepreneurship education. In the implementation of digital innovation and entrepreneurship education in our country, there is a lack of practical interaction and emphasis on theoretical exploration. Therefore, developing a digital innovative education model that integrates industry and education can achieve the integration of the supply side of talent cultivation and the demand side of industry and business. At the same time, we aim to build an interconnected and integrated platform for sharing resources among universities, in order to provide a practical foundation for promoting the future development of digital science education resource co construction and sharing.

In recent years, education scholars from all walks of life in China have also conducted extensive research on digital innovation and entrepreneurship education models. Lu Qiaoqiao[6] believes that the high-quality development of digital education in universities requires collaboration to enrich the digital resources and diverse subjects of education and teaching. Zhong Chenglin[7] et al. found that the digitalization of the education industry has a growth and diversified impact on promoting economic development.

The construction of digital resources abroad began to develop vigorously as early as the late 1980s. Currently, the most influential teaching resource platforms in various countries around the world include the US Education Resource Portal, the US Education Resource Information Center, the Australian Education Network, the Canadian Learning Object Library, and the UK National Digital Resource Center[8]. The digital education reform in Germany has always been at the forefront of the world. In "Bologna Digitalization", it is proposed to regard the application of digital technology as an effective means to solve the problems of opening up higher education resources, improving teaching quality, reforming evaluation and degree certification, and

promoting international talent flow in 21st century Europe. Higher education activities in the digital age should be carried out from a transnational and cross European perspective [9]. Digital education is being adopted worldwide due to its flexibility in learning, global exposure, and better cost-effectiveness.[10] The overall level of digital education in foreign countries is better than that in China, with good infrastructure construction and the ability to achieve good management and application of educational resources, forming a relatively complete system of co construction and sharing of educational resources.

2. Difficulties Faced by Digital Innovation and Entrepreneurship Teaching Research

In the context of "Internet plus", new industries, new industries and new occupations are developing rapidly. In order to better improve students' innovation and entrepreneurship ability, universities are imperative to reform digital innovation and entrepreneurship education. While promoting digital innovation, it is also necessary to objectively face the difficulties and challenges currently faced by China's digital innovation and entrepreneurship teaching and research institutes. These mainly include:

2.1. Insufficient Integration of Disciplinary Course Teaching and Professional Industries

The essence of entrepreneurial education lies in the combination of "theory + practice." However, practical teaching has always been a weakness in many universities, lacking actual guidance from enterprises and high-quality case studies. Teaching based on textbooks that encompass multiple professional fields often focuses too much on theoretical content explanation, lacking effective training oriented towards practical application in specific industries. Students may find themselves perplexed by questions such as "Why should I use what I have learned?" and "How should I apply what I have learned?" Therefore, it is necessary to make appropriate selections and adjustments to the teaching content based on the characteristics of each professional industry. This involves increasing relevant examples and cases, introducing real scenes from enterprise sites and production frontlines into classroom teaching, and adjusting teaching resources and requirements to integrate industrial elements into the teaching process. Solving this problem requires teaching teams to deepen cooperation with enterprises around the integration of industry and education, jointly build course teaching resources, and adapt to the needs of talent development in "new engineering + new liberal arts" disciplines.

2.2. Digital Educational Resources are Isolated, Scattered, and Lack Timeliness

There is no active and effective communication among universities regarding the co-construction and sharing of digital educational resources. Due to regional differences and the varying comprehensive strengths of universities, those with richer educational resources lack enthusiasm for resource sharing. Currently, there is no professional institution or organization to manage and distribute resources among universities, leading to a situation where each university operates independently. Educational resources are becoming generalized, making it difficult to meet individualized needs. Additionally, the coexistence of various resources during searches makes it challenging to find quality educational resources suitable for oneself. As a result, significant redundancy in educational resources construction occurs, causing substantial cost losses. Moreover, the resources are complex and lack specificity. Addressing this issue requires the establishment of an interconnected and integrated platform for university educational resources. It also necessitates continuous updating of innovative and entrepreneurial knowledge to achieve co-construction and sharing of digital educational resources, meeting the need for timely and personalized educational resources.

In response to the above research needs and current limitations, this study starts from the practical process of educational digitization, focusing on students as the main beneficiaries of educational services. It primarily investigates two aspects: the educational model of integrating online and offline industry-education collaboration and the OBE (Outcome-Based Education) oriented mechanism for shared construction of educational resources. Through "Internet Plus" and crowdfunding mechanisms for educational innovation, this study explores an integrated teaching model of industry-education collaboration both online and offline, promoting precise integration of educational chains, talent chains, innovation chains, and industrial chains. This aims to realize the organic unity of human value, educational value, and social value. Through interconnectedness and shared construction mechanisms, the study delves into the building of multidisciplinary integrated educational digital resources, deeply aggregating resources and continuously iterating them. This provides dynamic support for establishing a sustainable system of personalized services in digital educational crowdfunding and innovation, thereby fostering a sustainable digital education service innovation ecosystem.

3. Research on the Teaching Mode of Digitally Driven Integration of Online and Offline Production and Education

3.1. The Teaching Demonstration Mode of Integrating Industrial Elements With "Internet +".

Traditional specialized courses focus more on theoretical teaching and put high requirements on students' logical reasoning ability, abstract thinking ability and computational analysis ability. Under the background of the era of "New Engineering + New Liberal Arts", it is emphasized that science and technology and social orientation should be integrated crosswise in the cultivation of professional talents. Therefore, teaching courses should integrate industrial elements in the form of "Internet +", establish a teaching mode adapted to the times and form a higher education system integrating industry and education.

Teaching teams and industry enterprise experts are invited to jointly formulate teaching contents, strengthening the participation of enterprises in the process of curriculum construction. Industry enterprises are invited to participate in the design process of teaching programs in colleges and universities, cooperating with colleges and universities to establish "New Engineering + New Liberal Arts" courses and teaching programs that meet the requirements of the

development of national emerging technologies, paying attention to the development of interdisciplinary subjects, mostly using real enterprise projects as cases for teaching, attaching importance to the complementarity of theoretical knowledge and practical knowledge, and having a certain degree of foresight for majors or emerging majors. Teaching contents are carefully arranged, industrial elements are integrated into professional teaching, and teaching demonstration documents integrating industry and education are produced based on the concepts of combining professional industries with curriculum education and combining knowledge imparting with practical application. The infiltration and connection between enterprise cases and course practice are highlighted. Online course resources including industrial sites are added, including video cases, measurement cases, data processing cases, etc., and single-choice questions, multiple-choice questions and true or false questions are used to assess students' mastery degree. A complete media teaching resource centered on knowledge points is formed to meet the personalized learning needs of students.

3.2. The Digital Online and Offline Industry-Teaching Interaction Mode.

According to the actual characteristics of majors and the concept of industry-university-research cooperation, a large data sharing and analysis platform can be built based on school-enterprise cooperation to share real-time data on products, processes and production in multiple aspects. Students can use this platform to learn online about the whole-process management of enterprises in processes and production technologies. Meanwhile, teachers can also scientifically guide students through the data sharing platform on how to use data analysis to grasp the current actual state of on-site equipment, processes and production processes, analyze the risks and loopholes existing in the actual implementation of processes, management and production processes of enterprises, and put forward targeted solutions and measures.

Taking the course "Error Theory and Data Processing" as an example, the learning of this course is based on the knowledge of advanced mathematics, probability theory and mathematical statistics, linear algebra, etc. There are many key and difficult points involved in teaching, and students' logical and computational analytical abilities are insufficient. If the actual operation content of measurement in enterprises is added to the course to experience the theoretical knowledge of errors and improve students' understanding of abstract thinking abilities such as data measurement and analysis. Paying attention to the combination of enterprise needs and arranging teaching contents according to the actual situation of enterprises and increasing practical links, introducing the real scenes of enterprise sites and production front lines into the classroom can enable students to master the theoretical knowledge of errors in the production process, understand the significance of establishing detailed, accurate and reliable experimental data for the production process, make preparations for the learning of professional courses in the next stage, and also provide necessary knowledge reserves for engaging in related work in measurement and control technology in the future.

4. Research on the Establishment of a Multi-disciplinary Shared Innovation and Entrepreneurship Teaching Mechanism under the OBE Concept

4.1. Reverse Design Teaching Content Model under the OBE Concept.

Starting from the practical applications of counterpart enterprises and based on the outcome-based OBE education concept, it begins with the needs. The training objectives are determined by the needs, the graduation requirements are determined by the training objectives, the curriculum system is determined by the graduation requirements, and finally the teaching content is reversely designed by the curriculum system. In the course setting, it must refer to the teaching purpose. Students need to cultivate an active consciousness in learning. Teachers need to guide students to achieve the pre-determined learning objectives and transform their previous role as knowledge transporters. Teachers should organize teaching activities and select activity cases according to the existing achievements of students to ensure that students can achieve the predetermined goals. Evaluation methods are used to assess the learning results of students at specific stages, providing a basis for the scientific adjustment of the teaching model. Complex engineering problems to be solved are introduced from the actual needs of enterprises. These complex engineering problems are disassembled and analyzed to sort out the key content of corresponding professional courses, which will be taken as the core problems to be solved to design the teaching content.

4.2. Construction of Interconnected Digital Higher Education Resources.

Through the discussion of the concept of large educational resources, the characteristics of large educational resources are summarized, and the overall functional requirements for interconnection are put forward. By analyzing the relationship between resources and the existing knowledge system, a resource knowledge interconnection network is formed to realize the resource organization and management mode based on knowledge points and solve the bottleneck problem in resource management and organization. Build an interconnected framework that fits the characteristics of educational resources, deeply aggregate comprehensive educational resources, and continuously iterate high-quality educational resources. Using resource description information as the index of resource entity data, integrate the indexes of various platforms, so that the unified platform can access all connected resource platform resource libraries through a single integrated index, forming interconnectivity of resources at the data level. By using the functional services provided by various educational resource platforms and educational applications as units, we aim to build interconnectivity between application services of different applications. By calling and combining the application functional services of China Unicom, we provide more powerful personalized and intelligent services for individual platforms, achieving interconnectivity of resources at the application level.

5. Conclusion

The educational model that combines digital innovation with OBE (Outcome-Based Education) has significant strategic importance in improving the quality of undergraduate education and independently cultivating high-level talents in the process of building a powerful country in higher education. Colleges and universities should strive to explore and construct a digital teaching environment that supports the development of undergraduates.

In terms of curriculum objectives, emphasis should be placed not only on the achievement of summative objectives but also on the generative objectives in the educational process. Regarding curriculum content, teachers should conduct teaching based on the compiled curriculum as the foundation and core, and at the same time combine it with the practical application content in line with industrial needs. The combination of the two enriches students' learning content instead of presenting it to students as fixed information or standard answers. According to the actual needs of teaching, teachers can further deepen and expand at any time, so as to better stimulate students' judgment and insights and enable students' understanding to develop to different extents. In terms of curriculum evaluation, attention should be paid not only to goal-based evaluation, which emphasizes the achievement degree of predetermined goals, but also to goal-free evaluation, which conducts evaluation based on the actual results of the curriculum, so as to avoid excluding some meaningful educational results from the evaluation scope. All in all, efforts should be made to balance the prescriptiveness and generativeness of education in education.

Against the background of the big data era and in line with the development needs of education in the new era, promoting the digital transformation of education can lay a solid foundation for colleges and universities to clarify their school-running orientations and achieve high-quality development. To this end, universities need to focus on improving infrastructure, formulating strategic plans, perfecting organizational systems, and innovating education and teaching through a comprehensive digital transformation of the OBE teaching model. This will fully leverage the important value of digital technology in educational and teaching innovation, enhance the practical significance of basic teaching through the integration of industry and education, and create a new ecology of education and teaching, as well as a new pattern for cultivating applied talents.

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