

Practice and Exploration of the Development Path of Innovation and Entrepreneurship Studio Based on PBL

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Abstract—Combining the current situation of Taishan University and the existing research on "innovation and entrepreneurship" at various universities in China, from the perspective of "integration of industry and education", under the concept of PBL, this study explores the development path of the innovation and entrepreneurship studio. Through field research, questionnaire surveys, interviews, and other methods, the project-based teaching model based on the studio is analyzed. This study aims to provide a basic understanding of implementing the project-based studio teaching model for applied undergraduate institutions and provide reference suggestions for optimizing the existing problems of this teaching model. It is committed to cultivating students' entrepreneurial awareness and innovative spirit, assisting teachers and students in carrying out innovation and entrepreneurship practices, and building a student-faculty learning team pursuing innovative ideas.

Index Terms—Information technology, Complex Dynamic Systems, Professional development.

I. INTRODUCTION

In recent years, the Ministry of Education and various universities have been carrying out reforms in innovation and entrepreneurship education, especially after the promulgation of a series of policy documents by the state in 2015, encouraging universities to actively explore ways to help students realize their entrepreneurial dreams on the road of innovation and entrepreneurship education development, and requiring the exploration and establishment of a new mechanism for cultivating innovative and entrepreneurial talents oriented towards social needs. Against this background, combined with the integration of discipline and professional resources and innovation and entrepreneurship resources, the innovation and entrepreneurship studio, with its "small but exquisite" advantages, has been widely concerned by all sectors of society as a spontaneous grassroots organization from the bottom up in the reform of education and teaching[1].

In 2022, General Secretary Xi Jinping pointed out in his report to the 20th National Congress of the Communist Party of China: "Education, science and technology, and talent are the foundational and strategic underpinnings for China's overall development of socialist modernization. We must adhere to the philosophy that science and technology are the primary productive forces, talent resources are the primary

resources, and innovation is the primary driving force. We will fully implement the strategy of rejuvenating China through science and education and the strategy on developing a quality workforce for the country. We will open up new areas and arenas of development, and keep creating new growth drivers and competitive strengths." The important speech at the 20th National Congress of the Communist Party of China has pointed out the direction for doing a good job in innovation and entrepreneurship work in colleges and universities under the new situation and has greatly promoted the progress of "innovation and entrepreneurship" work[2][3]. At present, innovation and entrepreneurship education has become a highly concerned theoretical and practical issue for various units and scholars. Whether it is top universities or ordinary colleges, many universities and individuals have conducted a lot of research on how to carry out innovation and entrepreneurship education.

Tongji University has proposed the "competition-education-combined" model for cultivating innovative and entrepreneurial talents, Jilin Normal University has proposed the integration of innovation and entrepreneurship education into STEM education, and Linyi University has implemented a dual-creation education system of "general education + professional education + innovation and entrepreneurship education + innovation and entrepreneurship practice", combining curriculum and practice to form a system that integrates theory, practice, and hands-on experience. These cutting-edge training concepts fully tap into the elements of innovation and entrepreneurship education, forming an innovative model that combines practical and theoretical literacy.

The project-based teaching model[4][5] has been widely acclaimed and rapidly developed at different levels and different types of education, such as ordinary primary and secondary education, general higher education, and vocational education. Many countries have also listed it as an important teaching and learning method for educational reform, such as "project-centered learning" in the United States, "project week" activities in Germany, and corresponding project learning courses. In the teaching implementation process, it also presents different forms of expression. In the context of deepening integration of industry and education and school-enterprise cooperation, to better cultivate the high-tech and skilled talents needed by society, and to closely integrate teaching activities with



enterprise production activities, some applied undergraduate colleges and universities with conditions have explored and implemented project-based studio teaching models.

In 2021, Taishan University was selected as one of the first batch of supported universities for applied undergraduate construction in Shandong Province. The School of Physics and Electronic Engineering at Taishan University has promoted the construction of an applied university through the integration of industry and education, and has achieved good results in various national innovation and entrepreneurship competitions. Through a survey of the innovation and entrepreneurship education studios already established in various schools of Taishan University, combined with the current situation of Taishan University and the existing research on innovation and entrepreneurship at various universities in China, there are currently few studies on the project-based innovation and entrepreneurship studio teaching model in applied undergraduate universities, and the existing research content is scattered and the research scope is narrow, with relatively single research methods. Therefore, to promote the effective development of innovation and entrepreneurship work at Taishan University, this study conducts research on the development path and concept of the innovation and entrepreneurship studio under the PBL concept, aiming to cultivate students' entrepreneurial awareness and innovative spirit, assist teachers and students in carrying out innovation and entrepreneurship practices, and build a student-faculty learning team pursuing innovative ideas.

II. BACKGROUND AND IMPORTANCE

A. Studio

This study defines a studio as a place for skill training and talent cultivation at applied undergraduate universities, which is a teaching platform for applied undergraduate universities to cooperate with enterprises. The research objects are studios established by "dual-qualified dual-teacher" teachers at applied undergraduate universities, as well as studios established by a "dual-teacher structure" jointly composed of universities and enterprises. These studios can be specifically for serving teaching practice to simulate enterprise operations, or they can be based on real enterprise operations[6].

B. PBL(Project-based Learning)

Project-based teaching mode is defined as: Under the guidance of multiple intelligence theory and pragmatism theory, it emphasizes the teaching concept of "student-centered, teacher-led". With projects as the carrier, by introducing real projects or adopting simulated virtual projects, a simulated real work situation is created, aiming to cultivate students' hands-on practical ability, teamwork, and problem-solving abilities, as well as an integrated teaching

activity of theory and practice. The implementation of project teaching should meet the following conditions: First, the design of the teaching project should be related to students' interests and have a certain level of challenge. Second, it should be directly related to actual production tasks or production processes in enterprises, originating from production and life practices[7]. Third, students can independently formulate and implement plans during the project teaching process, organize and arrange the implementation of the project according to their own conditions, and carry out self-directed learning and self-exploration. Fourth, there should be a certain output of results after the learning is completed.

III. RESEARCH DESIGN

The project-based studio teaching mode refers to teaching activities carried out in the studio context with projects as the carrier. Through the construction or introduction of the studio teaching platform, an enterprise expert has been added as a teaching subject, forming a teaching team jointly composed of on-campus professional teachers and enterprise experts, fully embodying the concept of school-enterprise cooperation in personnel training. With projects as the platform and studios as the carrier, the project teaching method is used to carry out integrated teaching activities that combine work and study, aimed at cultivating students' professional competence, practical problem-solving abilities, and teamwork spirit.

A. Research Subjects

First, theoretical research is conducted on the teaching model of innovation and entrepreneurship studios based on PBL (project-based), including the connotation, characteristics, theoretical basis, and evaluation attitudes (mainly including the evaluation attitudes of studio teachers, students, and school-enterprise cooperation units towards this teaching model) of the project-based innovation and entrepreneurship studio teaching model. Second, the problems existing in the application of the PBL (project-based) innovation and entrepreneurship studio teaching model at Taishan University are summarized, and optimization countermeasures and suggestions are proposed. Taking the existing personnel of the studio as the sample, a questionnaire survey is used to investigate students' attitudes towards innovation and entrepreneurship to study the effectiveness of the project-based learning in the innovation and entrepreneurship studio, summarize experiences, optimize innovation, and promote the continuous deepening and improvement of the construction of dual-creation education. Third, the optimization design of integrating the PBL concept into the innovation and entrepreneurship studio is carried out to improve the effectiveness of entrepreneurship. online resources are vigorously developed, with the support of the "online project guidance" scaffold, a dual-teacher system is implemented, and an expert mentor



resource pool and excellent case resource pool are established. Combined with cooperation needs and competition orientation, knowledge construction is promoted. Multi-dimensional evaluation is used for result warning and process intervention. With modern education concepts as the guide, cutting-edge project management strategies are employed for direction guidance and cycle management. [8] discussed that The study of viruses and their genetics has been an opportunity as well as a challenge for the scientific community. The recent ongoing SARS-Cov2 (Severe Acute Respiratory Syndrome) pandemic proved the unpreparedness for these situations. Not only the countermeasures for the effect caused by virus need to be tackled but the mutation taking place in the very genome of the virus is needed to be kept in check frequently. [9] proposed a method in which the minimization is performed in a sequential manner by the fusion move algorithm that uses the QPBO min-cut algorithm. Multi-shape GCs are proven to be more beneficial than single-shape GCs.

B. Key Issues to be Addressed

The first part is the application status of the project-based studio teaching model at Taishan University. It mainly includes two aspects: one is the specific manifestation of the application of the project-based studio teaching model, which can be reflected in the system constructed and the operation and management mechanisms. The second is the evaluation attitude towards the application of the PBL-based innovation and entrepreneurship studio teaching model at Taishan University, which can be reflected in the evaluation attitudes of studio teachers, students, and employers towards the application of the project-based teaching model based on the studio. The second part is the main problems and their causes in the application of the project-based studio teaching model at Taishan University. Based on the above research questions, this study will conduct an in-depth analysis of the project-based studio teaching model. The third part is the issue of the effectiveness of college students' entrepreneurship. The disconnection between entrepreneurship training content and industry development has been a long-standing pain point in entrepreneurship training. Moreover, in the context of the innovation economy, more college students are starting businesses, but college students still face problems such as insufficient innovation and entrepreneurship capabilities, lack of entrepreneurial practical experience, lack of guidance for entrepreneurial projects, and financing difficulties, which affect the effectiveness of college students' entrepreneurship.

C. Program Design

Currently, most research focuses on the project-based innovation and entrepreneurship teaching model or studio teaching model in vocational colleges[1], and there is basically no literature specifically researching the project-based studio teaching model in applied universities, making this study a pioneering effort. First, it is necessary to

sort out existing research achievements, understand the deficiencies in research, and understand the origin and development of the "studio system" teaching model. The main characteristics and development stages of the "studio system" have been analyzed[2]. Next, by drawing upon literature with enlightening implications for this research, the project-based studio teaching model is theoretically elaborated, including its connotation, characteristics, and theoretical basis, to present a complete understanding of the project-based studio teaching model. Then, through field research, questionnaire surveys, and interviews, the current implementation status of the innovation and entrepreneurship teaching model at Taishan University is investigated, with a focus on analyzing its implementation effects and existing problems. Subsequently, based on the results of empirical analysis and combined with relevant theories, the project-based innovation and entrepreneurship studio teaching model is explored.

The PBL-based innovation and entrepreneurship training model consists of six modules: teacher team, student team, practical training, curriculum-competition integration, classroom teaching, and digital infrastructure. Through in-depth research, we found that Taishan University's PBL (project-based) innovation and entrepreneurship model is distinctive.

In terms of the teacher team, Taishan University has formed a diverse teaching force. Classroom teachers focus on imparting basic subject knowledge. Although they have a shallow understanding of business participation and innovation and entrepreneurship, their professional knowledge lays a solid theoretical foundation for students. The enterprise mentors, on the other hand, have rich social experience and a profound understanding of innovation and entrepreneurship. Their practical guidance provides students with valuable practical opportunities. Additionally, the university invites outstanding alumni to share their experiences on campus, and their successful cases further ignite students' enthusiasm for innovation and entrepreneurship.

Regarding the student team, Taishan University adopts a "senior students leading junior students" approach, where seniors help newcomers quickly integrate into the atmosphere of innovation and entrepreneurship. The university regularly organizes various innovation and entrepreneurship activities, allowing students to understand and learn about entrepreneurship through practical experiences, not only honing their practical abilities but also enhancing terms of practical training, Taishan University has designed four levels: beginner, intermediate, advanced, and expert. Through a digital platform, students are provided with a rich variety of practical projects. The university encourages students to actively participate in innovation and entrepreneurship competitions and incorporates competition results into entrepreneurship practice credits, enabling students to practice and consolidate their knowledge



application abilities through the curriculum-competition integration model, enhancing their competitive spirit.

For classroom teaching, Taishan University adopts a project-based teaching approach, enabling students to gain an in-depth understanding of the various stages of innovation and entrepreneurship, including project establishment, implementation, conclusion, and summary. Through knowledge learning, group discussions, presentation Q&A sessions, and other activities, students' knowledge reserves, teamwork abilities, and thinking abilities are effectively enhanced. In terms of digital infrastructure, Taishan University fully utilizes modern technological means, establishing communication channels such as WeChat groups and QQ groups, as well as smart classrooms and high-speed networks for practical training camps, providing students with a convenient and efficient digital learning environment. In summary, Taishan University's PBL-based innovation and entrepreneurship model has achieved remarkable results in multiple aspects, laying a solid foundation for cultivating talents with an innovative and entrepreneurial spirit and practical abilities.

While Taishan University's original innovation and entrepreneurship model has achieved some success in the Department of Physics, its university-wide popularization has not been entirely satisfactory. This is mainly reflected in the relatively low understanding and participation of students from other schools and majors in innovation and entrepreneurship, lacking sufficient enthusiasm and activeness. Although the Department of Physics has done relatively well in innovation and entrepreneurship, there are still some issues. Many students, after entering the university, often rush to pursue short-term goals due to the pressure of postgraduate entrance exams or other reasons, failing to truly engage in innovation and entrepreneurship activities in depth. As a result, their practical experience and skills in innovation and entrepreneurship are not fully honed, making it difficult for them to realize their full potential in their future career development.

Furthermore, the follow-up degree of enterprise mentors in the innovation and entrepreneurship process is also insufficient. For various reasons, some enterprise mentors are unable to frequently communicate and interact with the university and students, sometimes only coming once a month or even once a quarter. Such low-frequency communication makes it difficult for students to promptly and effectively resolve the problems they encounter in the innovation and entrepreneurship process, affecting the effectiveness and quality of innovation and entrepreneurship. To improve this situation, Taishan University needs to take a series of measures to strengthen the popularization and promotion of innovation and entrepreneurship education, improve student participation and practical abilities. At the same time, it is also necessary to enhance communication and cooperation with enterprise mentors to ensure that they can play a greater role in the

innovation and entrepreneurship process and provide better guidance and support for students. Only in this way can Taishan University truly promote greater progress and achievements in its innovation and entrepreneurship endeavors.

IV. CONCLUSION

The dual-creation studio in universities is an important carrier and strong support for carrying out reforms in innovation and entrepreneurship education. In line with Taishan University's original intention of integrating industry and education, through an in-depth analysis of the project-based studio teaching model at Taishan University, this study provides a basic understanding for applied undergraduate institutions to implement the project-based studio teaching model, which is conducive to improving the application of the project-based studio teaching model in teaching. By integrating actual needs into teaching design and innovative exploration, and leveraging project practices and the dual-teacher structure of the studio, growth and improvement can be achieved in a broader competitive process. Through analyzing the in-depth problems in the current research and proposing specific countermeasures and suggestions for optimizing the teaching model, this study helps applied undergraduate institutions to prevent or improve problems in practice when implementing the project-based studio teaching model, thereby more effectively fulfilling its function in talent cultivation.

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