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On Development of School- Enterprises Cooperative Education in China: A Literature Review (1998-2023)

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Abstract: School-enterprise cooperation education strengthens the connection between schools and enterprises, and cultivates qualified talents for economic development. This study aims to analyze the characteristics of existing research on school-enterprise cooperation in China. A total of 1299 studies on school-enterprise cooperation were selected for analysis from the research articles collected by China Social Sciences Citation Index (CSSCI) in the CNKI database over the past 25 years. Firstly, Cite Space software was used to visualize the number of published papers, research hotspots, and research trends for each year. Subsequently, a content analysis was conducted on the main research hotspots of school-enterprise cooperation in China. The results indicate that the publication volume of research papers on school-enterprise cooperation in China shows a trend of first increasing and then decreasing. The evolution of research topics spans three different stages, influenced by educational policies. The main focus areas include school-enterprise cooperation modes, talent training modes through school-enterprise cooperation, collaborative innovation and practical teaching in school-enterprise cooperation, as well as collaborative training of talents in new engineering fields. This review aims to describe current research prospects and provide a reference for academic exploration in future school-enterprise cooperative education.

Keywords: Higher Education, School Enterprise Cooperation, Literature Review.

1. Introduction

Higher education institutions bear the responsibility of nurturing specialized talents that are in line with the needs of society. The efficient cultivation of talents that meet the demands of enterprises is a crucial question that every university must address. The school-enterprise cooperation model, as proposed by Wang Xiaoxin in 2008, presents a novel approach to talent cultivation where universities and enterprises collaborate to develop applied talents. This form of education strengthens the relationship between academic institutions and businesses, serving as an effective means to produce qualified talents for economic development. The establishment of the World Cooperative Education Association in 1983 signaled the global trend towards cooperative education within higher education reform. In April 1991, China further solidified this trend by founding the "China Industry-University Cooperative Education Association," marking a transition towards organized and planned social behavior in China's cooperative education practice (Chen Jiefang, 2006).

In recent years, domestic scholars have conducted in-depth research on school-enterprise cooperation, providing valuable theoretical references and practical guidance for the practice of school-enterprise cooperation (Zhang Lian, 2002, 2010). However, for a long time, there have been many problems in school-enterprise cooperation. These include the dilemma of "hot schools and cold enterprises" (Cao Tunyu, 2007), loose "school-enterprise cooperation" (Guo Wenli, 2008), and numerous issues in current applied undergraduate practical teaching (Yu Guojiang, 2014). Solving the problems of school-enterprise cooperation and improving the quality of school-enterprise cooperation education remains an urgent concern in the education industry.

Although extensive research has been conducted in the past few decades, empirical research in this field is still relatively scarce. Therefore, this study aims to fill this gap by comprehensively analyzing literature on school-enterprise cooperative teaching. The Cite Space software is used for visual analysis of the existing literature, while content analysis is employed to explore the research content and focus. The purpose of this study is to elucidate the current status of research on school-enterprise cooperation and chart future research trajectories, ultimately providing valuable insights for academic research in the emerging field of school-enterprise cooperation education.

This study will evaluate the development of school-enterprise cooperation in China from 1998 to 2023, focusing on the influencing factors, teaching models, talent training programs, practical teaching systems, and collaborative innovation in the construction of new engineering disciplines in higher education. The study will identify the challenges faced in improving the quality of school-enterprise collaborative teaching and analyze existing opportunities for future enhancements in teaching methods. Consequently, this study aims to provide deeper insights into the evolution of school-enterprise cooperative teaching in China over the past 25 years and offer suggestions for future improvements in this field.

2. Methods

This article collects a total of 1299 articles from the CSSCI journals in the CNKI database, focusing on the "school enterprise cooperation" and "higher education" disciplines.

The time range of this literature corpus spans 25 years, from 1998 to 2023. Subsequently, the Cite Space visual analysis method was used to analyze the content of the accumulated literature. This analysis method can comprehensively explore and identify the hot topics and focuses in the field of school enterprise cooperation research in recent years.

3. Findings

3.1. Number of Research Publications

From 1998 to 2023, the China National Knowledge Infrastructure (CNKI) CSSCI journal database published a total of 1299 articles on the subject of "higher education," with the main focus on "school enterprise cooperation," indicating that school enterprise cooperation has always been a focus of attention for educators and relevant experts. Figure 1 shows the trend of the number of articles published on school enterprise cooperation over the past 25 years. Since 1998, research results on school enterprise cooperation in higher education in China have grown rapidly, reaching a peak in 2018. This was a milestone year, with a total of 119 papers published, setting the highest annual output in 25 years. Nevertheless, after 2018, the trend of collaborative research papers between schools and enterprises has shown a downward trend, but the publication volume in 2023 has increased by a percentage of 12% compared to the previous year. The recent decrease in research activities marks a potential shift in academic focus on school enterprise cooperation or saturation of specific research topics.

The number of papers retrieved from CSSCI source journals in the China National Knowledge Infrastructure (CNKI) database, spanning from 1998 to 2023, is depicted in the figure, with the primary focus being 'school enterprise cooperation' within the discipline of 'higher education'.

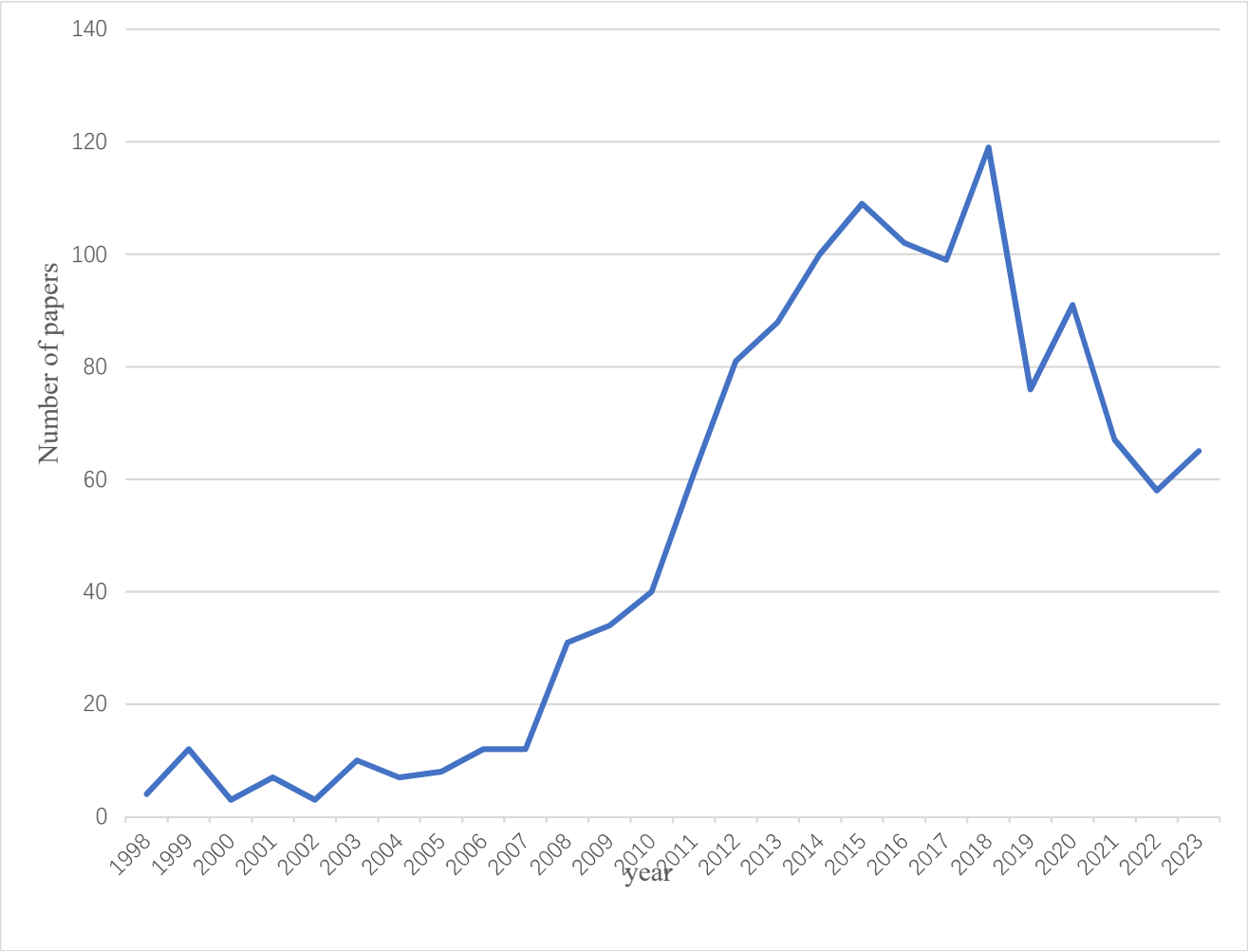


Figure 1. Annual publication scale

3.2. Research Trend Analysis

In order to explore the cutting-edge evolution of school enterprise cooperation from 1998 to 2023, this study utilized the Detect Bursts function of Cite Space software to analyze the mutation points of keywords in this field. Keywords with high citation rates can, to some extent, represent research trends and priorities during this period. Figure 2 reveals the evolution of the top 25 hot topics in the field of school enterprise cooperation from 1998 to 2023.

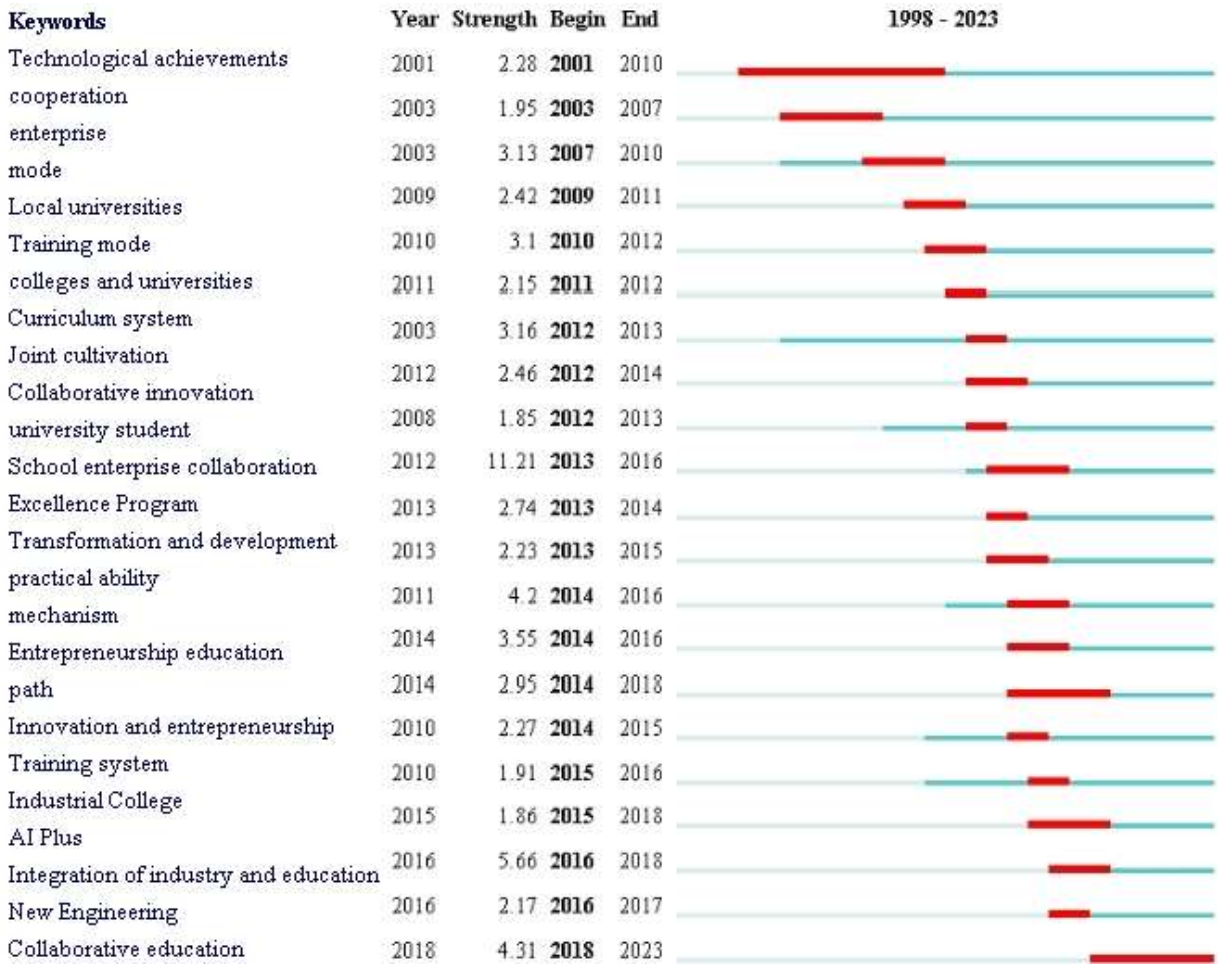


Figure 2. Top 25 Keywords with the Strongest Citation Bursts

According to Figure 2 and in combination with national policy documents, the evolution of school enterprise cooperation is classified into three time periods: 1998-2011, 2012-2017, and 2018-2023. From 1998 to 2011, the main keywords in this stage included "universities", "enterprises", "training models", "cooperation", "scientific and technological achievements", etc. The primary reason for these keywords is that, in 1998, the 15th National Congress of the CPC put forward the Action Plan for Revitalizing Education in the 21st Century, which involved the reform of higher education and laid a foundation for school-enterprise cooperation. Therefore, the main research focus during this period was on how schools and enterprises cooperate and the mode of school-enterprise cooperation.From 2012 to 2017, the main keywords of this stage, such as "practical ability", "collaborative innovation", "excellent plan", and "transformation and development", marked a significant shift in research direction. The reason is that in 2012, the Ministry of Education issued several opinions on comprehensively improving the quality of higher education, which proposed goals and measures to comprehensively improve the quality of higher education, including strengthening school-enterprise cooperation and enhancing students' practical and innovative abilities. Therefore, the focus of school-enterprise cooperation shifted to the cultivation of students' practical and innovative abilities.From 2018 to 2023, keywords such as "Industrial College", "New Engineering", "Collaborative Education", and "Artificial Intelligence" dominated. This transformation is due to the joint release of the "Opinions on Accelerating the Construction and Development of New Engineering Majors and Implementing the Excellent Engineer Education and Training Plan 2.0" by the Ministry of Education, the Ministry of Industry and Information Technology, and the Chinese Academy of Engineering in 2018. This opinion aims to cultivate outstanding engineers who can adapt to the requirements of the new era through school-enterprise cooperation. This indicates that research during this period was largely influenced by new policies. The characteristics of the research indicate collaborative cultivation of talents in the new engineering field.

3.3. Research Foci

Based on the top 25 keywords and mutations in Figure 2, the author further analyzes the research content and concludes that Chinese scholars' research on school-enterprise cooperative education over the past 25 years has mainly focused on the following areas: school-enterprise cooperation modes and school-enterprise talent cultivation modes; school-enterprise cooperative practical teaching systems and collaborative innovation; integration of industry and education, collaborative education, and new engineering disciplines.

3.3.1. Study on the School-Enterprise Cooperation Model and the School-Enterprise Talent Training Model

Chinese scholars have conducted a lot of research and explanations on the school enterprise cooperation model and the school enterprise cooperation talent training model. Table 1 lists several representative research results:

Table 1. Representative achievements of school enterprise cooperation model

Subject	Main viewpoints	author
On the Innovation of Cooperation Models between Universities and Enterprises in China	To innovate the mode of school-enterprise cooperation based on the existing foundation, it is necessary to follow certain principles, establish new concepts of school-enterprise cooperation, establish a resource exchange centered on the government, universities, and enterprises from a macro perspective, and explore as flexible and diverse a mode of school-enterprise cooperation as possible from a micro perspective. Scholars propose ten suggestions for innovating school-enterprise cooperation models based on the current situation in China.	Jiang Dan (2007)
Interactive talent cultivation model between higher education institutions and enterprises	The talent demand model of Chinese enterprises has undergone significant changes, and under the traditional model, higher education institutions still mainly rely on internal evaluation standards as the standard for talent cultivation. However, the two cannot be directly connected. Researchers have addressed the above issues by constructing an interactive talent training model between higher education institutions and enterprises, which is based on three mechanisms: talent supply and demand information exchange, human resource flow, and talent evaluation.	Tan Dan (2010)
Goal oriented talent cultivation model	The achievement of talent cultivation goals in higher education relies on a scientific talent cultivation model. The 'goal-oriented' model comprises an innovative curriculum system based on 'enterprise expert development', an innovative experimental environment mirroring real enterprise scenarios, an innovative operational mechanism to foster a 'dual teacher' team, and an innovative talent training approach with the aim of cultivating applied innovative talents.	Fan Baoxue (2010)
The school enterprise cooperation model in the entrepreneurial practice of college students	School-enterprise cooperation is an entrepreneurial practice that allows college students to fully utilize their knowledge based on their major. It addresses the two major issues of college students' lack of practical experience and lack of funds. At the same time, it links college student entrepreneurship with local characteristics, local economic construction, and enterprise development, achieving a win-win situation for the local community, enterprises, and college students.	Sun Xiuli (2011)
The "3+1" talent training model of school enterprise cooperation	The current situation of cooperative education between universities and enterprises is clarified using questionnaire survey research methods, with university teachers and students as the research subjects. This paper demonstrates the indicator system of the survey questionnaire for university teachers in school-enterprise cooperation. Based on the data collected from the questionnaire survey, quantitative analysis is conducted from multiple perspectives, such as cooperation awareness, attitude, behavior participation, interaction, and satisfaction. The existing problems in the process of school-enterprise cooperation are deeply explored, providing a scientific basis for the formation of a long-term teaching management mechanism for further school-enterprise cooperation.	Song Zuozhong ; Liu Xingli ; Guan Fengyan (2013)

3.3.2. School Enterprise Cooperation in Practical Teaching and Collaborative Innovation

1) Practical teaching mode and practical teaching system

With the deepening of school-enterprise cooperation, the academic community is paying increasingly more attention to practical teaching. Tan Hongyan and Yu Ge (2016) proposed a new practical teaching model in which students, universities, and enterprises provide feedback to each other and jointly formulate practical teaching training plans. This is done in addition to the traditional enterprise-ordered talent training model, based on the problems existing in current practical teaching in universities, in order to promote the cultivation of multi-level engineering talents.

Furthermore, Fu Xiaoyun and Zhu Yihao (2015) explored the integration model and work details of school-enterprise joint research and development centers and professional courses. They also investigated how to promote the diversified development of practical teaching methods and means in industrial design, based on industry-university-research cooperation. This was achieved using professional courses as carriers, enterprise needs as topics, and teachers and enterprise personnel as joint teachers.

Meanwhile, taking the International Economics and Trade major at Oujiang College of Wenzhou University and the Agricultural Water Conservancy Engineering major at Gansu Agricultural University as examples, this study explores how to promote the practical teaching model of "school-enterprise cooperation" and the construction of a "four-level, seven-module" practical teaching system and platform (He Shouchao, Chen Ting, Pan Weizhen & Zhang Maoyu, 2015). Bai Fei and Wan Yuan (2014) emphasized that the construction of a school-enterprise collaborative practical teaching system requires enterprises to participate in school practical teaching throughout the entire process, in depth, and in the long term. The construction path involves clarifying training objectives, coordinating and arranging practical teaching processes, forming a practice-oriented school-enterprise teaching team, and improving conditions and institutional construction.

2) Collaborative innovation

In terms of collaborative innovation between schools and enterprises, Ji Zhaohua and Xi Haixia (2015) conducted a comparative study on the collaborative innovation models of industry, academia, and research in universities in the United States, the United Kingdom, Germany, Japan, and China. Based on an analysis of the guarantee mechanisms, main functions, content, and levels of various collaborative innovation models between industry, academia, and research in universities, they proposed suggestions and path analysis to promote the development of collaborative innovation in Chinese universities. Dong Xin, Wu Wei, and Wang Yiheng (2014) introduced the concept of collaborative innovation into school-enterprise cooperation and conducted in-depth research on the mode and content of school-enterprise cooperation under the concept of collaborative innovation, from the perspectives of a theoretical support framework, a cooperation mode framework, a practical teaching framework, and a scientific research collaborative innovation framework.

They analyzed the operating mechanism of the school-enterprise cooperation mode from macro, meso, and micro levels, and put forward constructive suggestions for Chinese universities to cultivate applied talents and improve the ability to transform scientific research achievements in the new context of school-enterprise cooperation. Cao Qinglin (2014) outlined the basic connotation of collaborative innovation, explored the role positioning of universities in collaborative innovation, analyzed the internal logic of collaborative innovation and high-level university construction, and also analyzed the preliminary achievements and main problems of collaborative innovation in Chinese universities. Taking Henan Agricultural University as an example, Wang Wenliang et al. (2015) used grounded theory to analyze the driving factors of collaborative innovation between schools and enterprises. The study found that the driving factors of collaborative innovation between schools and enterprises comprise six factors: human capital, technological innovation, strategic innovation, platform construction, financial support, and cultural concepts. Zhao Zhe (2014) took universities in Liaoning Province as an example to analyze the problems in the risk-bearing mechanism, benefit distribution mechanism, resource sharing mechanism, and communication between universities, enterprises, and research institutes in collaborative innovation. He proposed that the strategy to promote the construction of a collaborative innovation mechanism is to improve the government regulation and management mechanism, establish a reasonable benefit distribution mechanism, establish a scientific risk sharing mechanism, establish a comprehensive resource sharing mechanism, and establish a long-term communication mechanism between schools and enterprises. In response to the difficulties in the transformation and development of entrepreneurship education in newly established undergraduate universities, Yin Tianhe and Chen Zhirong (2015) analyzed the reasons for the difficulties in the transformation and development period of entrepreneurship education from the perspective of collaborative innovation, and proposed four strategies to promote the transformation and development of entrepreneurship education through collaborative innovation. Xu Quan, Wu Qiang and Liu Xin (2014) proposed to fully mobilize the creativity of various actors such as leading enterprises, universities, research institutes, and governments, achieve deep cooperation and integration across disciplines, industries, and departments, enhance the level of independent scientific and technological innovation of enterprises, and transform economic development.

3.3.3. Collaborative Cultivation of Talents in the Field of New Engineering

New Engineering is a direction for engineering education reform, based on the new situation of international competition and the new needs of national strategic development (Shi Weihua, Lv Cixian, & Zheng Shou, 2021). The construction of new engineering disciplines is a major action plan implemented by higher education institutions to deepen the reform of engineering education in response to major national strategic needs, new economic development, and industrial transformation and upgrading (Li Gang, Qin Kun, Wan Youchuan, & Shi Wenxuan, 2019). The integration of industry and education is an inevitable requirement for promoting the construction of new engineering disciplines, strengthening national strategic scientific and technological strength, and achieving innovation-driven development (Li Min, Zheng Qi, & Zhang Wei, 2022).

Starting from the core competencies that new engineering talents should possess, Zhou Ling and Fan Lixia (2021) and others investigated and understood the cognitive differences among different stakeholders regarding the core competencies of new engineering talents. They then investigated the current situation and problems in curriculum construction, including goals, content, implementation, and evaluation, and finally proposed suggestions to address these problems.Yin Tianhe and Chen Zhirong (2019) analyzed the problems faced by the cultivation of data engineering talents and the integration of industry and education from the perspective of application-oriented undergraduate colleges, combined with the actual situation of data engineering undergraduate talent cultivation at Ningbo University of Engineering. They then proposed the goals for data engineering talent cultivation and, based on these goals, designed an education support system that is suitable for it from four aspects: talent positioning, curriculum system construction, teacher team construction, and innovation and entrepreneurship education.Fu Lei et al. (2019) combined the history and reality of the development of engineering education, analyzed and studied the connotation, characteristics, laws, and development trends of new engineering disciplines. They proposed the concept and ideas of engineering education reform and innovation, and continuously explored new models of interdisciplinary and integrated engineering talent cultivation. Shen Liyong, Qi Shuyu, and Fei Lanlan (2021) emphasized that effective ways to solve the problem of internalization in the integration of industry and education in universities include: building an "engineering education community" with "teaching subjects + social forces", forming a "new system of engineering education" with "problem orientation + interdisciplinary integration", exploring a "new model of engineering education" with "teaching experiments + enterprise practice", and strengthening the "new teaching staff of engineering education" with "scientific research teachers + engineering mentors". Xu Xiaofei et al. (2020) summarized the "New Engineering Department of Harbin Institute of Technology" "Type Π" plan, emphasizing the "8" in it. The model provides a profound discussion on the content of the plan from eight aspects: talent training objectives, training programs, teaching models, faculty, school-enterprise cooperation, international exchanges, integration of general and specialized education, and college academies. It also provides a roadmap for the development of the new engineering discipline construction at Harbin Institute of Technology and its practical results. In the process of teaching practice, Zhou Ke, Zhao Zhiyi, and Li Hong (2019), based on the implementation of the "Excellent Talent Training Plan", broke down disciplinary barriers from three dimensions: "technical needs", "student needs", and "social needs", and launched a personalized "menu-style" hierarchical engineering education platform guided by new technologies. They broke down the barriers between schools and enterprises and created an engineering education model that is open, cooperative, collaborative, integrated, and innovative.

4. Discussion and Conclusion

After long-term exploration by domestic scholars and frontline teachers in higher education institutions, research on school-enterprise cooperative teaching has gradually entered a stage of multiple perspectives and levels. In terms of talent cultivation models, school-enterprise joint training has

become an important trend. This model focuses on the cultivation of students' comprehensive qualities, abilities, and job competitiveness. By combining the two different educational environments and resources of schools and enterprises, and adopting an organic combination of classroom teaching and student participation in practice, students can better adapt to market demand and improve their job competitiveness. In terms of the practical teaching system for school-enterprise cooperation, some schools and enterprises have begun to build a practical teaching curriculum system based on typical work tasks and real work processes, as well as setting up integrated course projects for practical training based on real work scenarios. This practical teaching system can help students better integrate theoretical knowledge with practice, improving their practical ability and problem-solving ability. Some universities and enterprises have begun to explore new cooperation models in cultivating talents in the field of new engineering through school-enterprise collaboration. For example, by jointly developing training programs, establishing joint laboratories, and conducting industry-university research cooperation, they can promote deep cooperation between schools and enterprises in talent cultivation, scientific research, and technological innovation, thus cultivating new engineering talents with innovative spirit and practical ability.

When delving into the field of collaborative teaching research between schools and enterprises, it is not difficult to find that there are still many topics worth further exploration. Firstly, focusing on the internal mechanism of school-enterprise cooperation, it is crucial for both parties to more accurately determine curriculum objectives and content, as well as optimize curriculum design and evaluation, in order to improve the quality of cooperative education teaching. However, how to achieve mutual benefit and a win-win situation between schools and enterprises in the design, organization, and evaluation of courses, thereby promoting deeper cooperation between both parties, is still an urgent problem that needs to be solved.

In summary, the research on school-enterprise cooperative teaching is a continuous and increasingly deepening process. Looking ahead to the future, it is necessary for us to continue to deepen the exploration and practice of school-enterprise cooperative teaching research, continuously improve and optimize the cooperation mode and mechanism, so as to make greater contributions to cultivating more high-quality talents with innovative spirit and practical ability. Through our joint efforts, we believe that school-enterprise cooperation in teaching will usher in broader development prospects.

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