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A Systematic Review of Effective Models in School-Enterprise Cooperation in China in the English and Chinese Literature

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***Abstract* - Against the backdrop of globalization and rapid technological development, the traditional Technical & Vocational Education (TVE) system is facing more and more challenges. As a rapidly developing economy, China is also exploring effective paths in combining education and industry. School-Enterprise Cooperation(S-EC), as an emerging education method, aims to realize the effective docking of education resources and market demand through close cooperation between schools and enterprises. At present, Chinese scholars have conducted extensive research on the model of S-EC, however, few systematic reviews of related studies were carried out. The purpose of this paper is to examine and assess the relevant literature concerning effective S-EC models in the last ten years from 2015 to 2024. The review includes sources in both Chinese and English languages. The author conducted individual assessments of titles, abstracts, and complete texts according to predefined eligibility criteria. 15 studies that met the eligibility criteria were included in the reviewed systematic review. Effective S-EC models mentioned in these articles can be summarized and classified into three types: School-led Model, Enterprise-led Model and School-Enterprise Cooperation Model, of which each is subordinate to 3-4 specific cooperation models.**

Keywords: **School-Enterprise Cooperation, Industry-Teaching Integration, Effective, Cooperative Models**

I. INTRODUCTION

Against the background of globalization and rapid technological development, S-EC has become an important way to promote China's TVE reform and foster the development of the industry. At present, there are various modes of S-EC in China, each of which has its own unique operation mechanism and practical effects, and also faces different problems and challenges.

A number of academic studies have confirmed that the school-led cooperation model has demonstrated significant innovation and practical value in the process of S-EC (He et al., 2017; Li, 2020; Lu et al., 2024; Sun, 2024; Wang & Gao, 2023; Xiao et al., 2023; Geng et al., 2023; Lin, 2023; Petticrew & Roberts, 2008). The Vocational Qualification Certification Model systematically aligns enterprise demand with educational content through the leading role of the school, ensuring that students can obtain vocational qualifications in line with industry standards (Gao & Wang, 2022; Lu et al., 2024; Agung et al., 2024; Sun, 2024; Xiao et al., 2023; Petticrew & Roberts, 2008). The Establishing Workshop and Training Base Model provides students with a practical platform, which enhances their practical skills and work adaptation ability while providing a real working environment, and also delivers talents to enterprises in line with actual needs (Li, 2020; Sesmiarni et al., 2023; Geng et al., 2023; Lin, 2023). The Establishing Laboratory and Research Center Model is to jointly invest in the construction

of advanced laboratories and research centers through the cooperation between schools and enterprises in order to promote scientific and technological innovation and the transformation of R&D results, thus realizing a win-win situation for the development of education and industry (He et al., 2017; Llopiz-Guerra et al., 2024; Lin, 2023).

In addition, the enterprise-led cooperation model is also one of the effective modes for S-EC to be carried out (Chen et al., 2023; Dai et al., 2015; Gao & Wang, 2022; Lu et al., 2024; Liu et al., 2017; Qi et al., 2022). The Modern Apprenticeship Model combines enterprise practice with school theory, allowing students to receive practical training in the enterprise while also taking relevant theoretical courses in the school, thus realizing the simultaneous improvement of skills and knowledge (Chen et al., 2023; Gao & Wang, 2022; Lu et al., 2024). Enterprises cooperate with vocational schools to formulate specialized training programs according to their own talent needs, and ensure that graduates have the professional skills and qualities required by enterprises through the Orderly Cultivation Model (Dai et al., 2015; Qi et al., 2022). The Vocational Education & Group Industrial Park Model can integrate enterprises, schools and other related resources to provide a comprehensive platform for vocational education that integrates teaching, practical training and employment, thus promoting the integration of industry and education in TVE (Chen et al., 2023; Liu et al., 2017).

The school-enterprise cooperation model is mainly a combination and variation of the previous two models, which is carried out in various modes (Chen et al., 2023; Gao & Wang, 2022; Liu et al., 2017; Qi et al., 2022; Wang & Gao, 2023; Zhou et al., 2022; Lin, 2023). The Dual-Professional Teacher Training Model improves the quality of teaching and the practical ability of students through the close cooperation between enterprises and schools to jointly train teachers with both theoretical and practical abilities (Qi et al., 2022; Lin, 2023). Joint Patent & Technology Development Model focuses on the cooperation of scientific and technological innovation and intellectual property rights, and realizes the effective connection between scientific and technological innovation and market demand by sharing resources, technologies and R&D results (Wang & Gao, 2023; Zhou et al., 2022; Lin, 2023). The School+Enterprise+Enterprise Model, on the other hand, connects the school and the actual cooperative enterprises through a service-oriented enterprise, which plays the role of a bridge in order to promote more effective S-EC (Liu et al., 2017), and it is a new type of cooperation model that has emerged in a specific context. The "School-in-Factory" & "Factory-in-School" Model integrates education and production, forming an integrated S-EC operation mechanism by setting up an entrepreneurial production line on campus or teaching facilities in the enterprise (Chen et al., 2023; Gao & Wang, 2022).

The purpose of this paper is to conduct a systematic review and comprehensive analysis of existing effective models of S-EC in China. The review aims to assess the current state of research in the field of effective models of S-EC in China and to point out the existing problems and shortcomings, with the aim of providing valuable references for future research and promoting the further development of China's S-EC.

II. MATERIALS AND METHOD

Design

Systematic review was conducted in this study followed (Petticrew & Roberts, 2008) guidelines.

Search Strategy

Retrieving a large number of articles requires a suitable database, and considering the time and need for systematic review, an electronic database is the best choice for retrieving articles. Petticrew & Roberts, (2008) also pointed out that electronic databases constituted the pre-dominant source of published literature collections.

Since this study aims to conduct a systematic review of effective S-EC models in China, the China National Knowledge Infrastructure (CNKI) was used as the primary database, which "is the world's largest full-text database of Chinese academic journals covering research in all disciplines (Li, 2020)". Meanwhile, Scopus was used as a supplementary database. By combining the two databases together to screen the articles for research, the research data were made more complete and enriched. Keywords in the two databases include School-Enterprise Cooperation, Industry-Teaching Integration, effective, and cooperative models.

Selection Criteria

Based on the research question, research design, research methodology, and time frame, the literature inclusion criteria must meet the following conditions:

The article inclusion criteria are as follows:

- The articles should be published academic articles, conference papers or proceedings.
- The article must contain "school-enterprise cooperation" or "integration of industry and education" in its title, abstract and keywords.
- The article should include an analysis and elaboration of effective S-EC models.
- The article should be written in English or Chinese.

The article exclusion criteria are as follows:

- The article is not available online.
- Articles not written in Chinese or English.
- Literature is not based on primary sources.

III. RESULTS

Study Selection

In the preliminary search stage, in order to obtain more relevant records, the author intentionally relaxed the search criteria and used "school-enterprise cooperation model" and "industry-teaching integration model" as keywords. 168 records in the Scopus database and 4109 records in the CNKI database, totaling 4277 records were found. However, these records contained a large number of records that were not related to the research field or duplicated research content. The total number of records was reduced to 721 by removing duplicates and adding keywords such as "effective" and "reasonable". The author screened the remaining 721 records for title, abstract, and keywords. In the end, 625 records with low relevance were removed and 96 records were retained for further screening. After applying the inclusion and exclusion criteria, 15 records were finally retained for data extraction.

After the screening was completed, the author thoroughly read all the included records and recorded the relevant information using an Excel spreadsheet. The data sheet was created by the author and the table included information such as search source (CNKI/Scopus), study title, author name, year of publication, research question, and type of study etc. The table was intended to provide a comprehensive overview of the key information of each article, which facilitates the author in writing the report. Figure 1 below illustrates the screening process, including the various steps of literature search, screening, eligibility assessment and final inclusion.

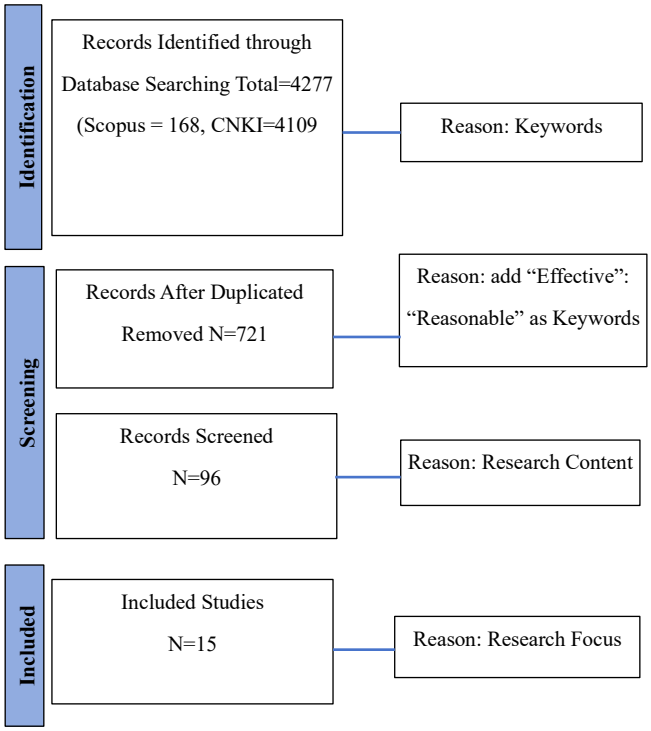

Fig. 1 PRISMA Flow Diagram

Study Characteristics

All of the studies were conducted in China, and most of them were qualitative, with only 2 articles being quantitative (Sesmiarni et al., 2023; Wang & Gao, 2023). Since the research is on effective S-EC Models, which are relatively broad, and some papers propose several different models, so there is a cross-duplication part of the research content of the 15 research papers. Among the 15 studies, 9 studies were dominated by School-led Model, 6 studies were dominated by Enterprise-led Model, and 7 studies were dominated by School-Enterprise Cooperation Model. Figure 2 shows the effective models concluded in the studies.

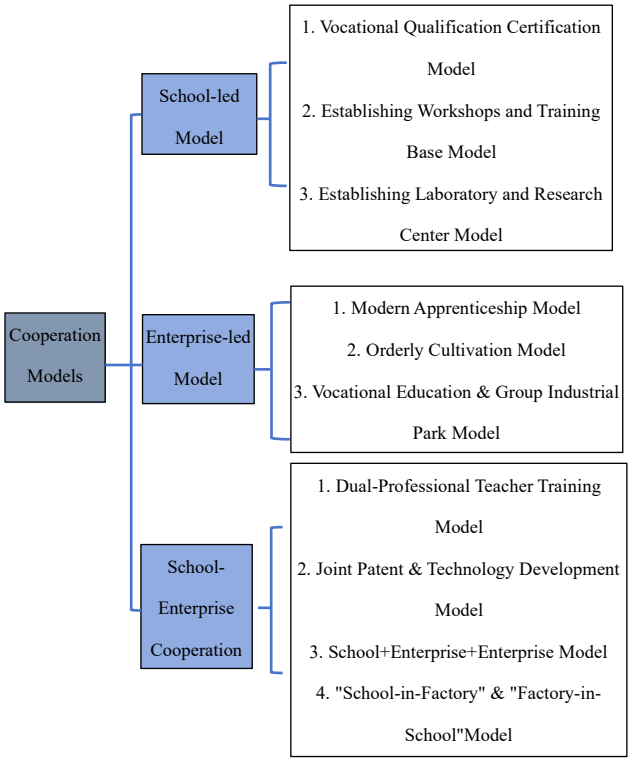

Fig. 2 Effective Models in China's S-EC

IV. Results from Selected Studies

Research Involving School-led Model

Four articles (Lu et al., 2024; Sun, 2024; Xiao et al., 2023; Petticrew & Roberts, 2008) of the nine studies of School-led Model discussed in the Vocational Qualification Certification Model. As one of the most effective modes of S-EC, the school has always been committed to improving the quality and industry adaptability of TVE through standardized vocational qualification certification. Among them, three articles (Lu et al., 2024; Petticrew & Roberts, 2008; Sun, 2024) pointed out that the popularization and application of the 1+X certificate system in higher vocational schools have significantly enhanced students' vocational skills and employment competitiveness. Meanwhile, one article (Xiao et al., 2023) pointed out that the effective implementation of vocational qualification certification needed to overcome the challenges of imperfect system and uneven allocation of resources, so TVE should be linked to the qualification certification, and through vocational qualification training as well as the examination, the vocational competence of the students would be continuously perfected, and the period of time would be matched with the employment needs of the enterprises, so as to enhance the effectiveness of S-EC.

Among the three articles (Li, 2020; Geng et al., 2023; Lin, 2023) on Establishing Workshop and Training Base Model, one (Geng et al., 2023) took the preschool education major as an example, pointing out that the core of this model lied in the school-led construction and management of training bases, and realized the combination of theory and practice through the establishment of long-term cooperative relationships with industrial institutions such as kindergartens and early childhood education centers. Li, (2020); Lin, (2023) believed that the joint construction of studios by schools and enterprises can not only improve students' design and innovation ability and comprehensive vocational quality, but also create a "dual-teacher" teaching team, forming a platform of mutual benefit and win-win situation, which can effectively connect the industrial demand with the education and training objectives, thus realizing high-quality talent cultivation.

Among the three articles (He et al., 2017; Wang & Gao, 2023; Lin, 2023) on Establishing Laboratory and Research Center Model, He et al., (2017); Lin, (2023) suggested that through the establishment of joint R&D laboratories and research centers, it's possible to promote the docking between schools and enterprises in terms of technological needs and research directions, so as to achieve resource sharing and complementary advantages. Wang & Gao, (2023) verified the validity of the method through example analysis and provides a reliable reference for the construction of joint laboratories between schools and enterprises.

Research Involving Enterprise-led Model

Among the six articles (Chen et al., 2023; Dai et al., 2015; Gao & Wang, 2022; Lu et al., 2024; Liu et al., 2017; Qi et al., 2022) of Enterprise-led Model, three (Chen et al., 2023; Gao & Wang, 2022; Lu et al., 2024) discussed Modern Apprenticeship Model. Gao & Wang, (2022) summarized the group's characteristic Modern Apprenticeship Talent Cultivation Model through empirical examples and pointed out that the model not only effectively improves students' practical skills, but also provides reference experience for higher vocational schools in the cultivation of Modern

Apprenticeship Talent Cultivation, while (Lu et al., 2024) pointed out that this model can provide actual case studies and expert opinions through the direct participation of enterprises, so that the teaching of the courses can be closer to the actual work demands, thus enhancing the practical ability and employment competitiveness of students.

In the two articles (Dai et al., 2015; Qi et al., 2022) on Orderly Cultivation Model, Dai et al., (2015) proposed a specific strategy to build an "order-based" cultivation path for vocational undergraduate live e-commerce talents, which expanded the connotation and extension of cultivation, optimizes the traditional point-to-point cooperation, and improved the practical training. Qi et al., (2022) discussed how to innovate the online course construction of higher vocational schools through the enterprise-led model under the background of "Internet+", and believed that this model can effectively transform the production and management tasks of enterprises into teaching projects, thus realizing the close integration of teaching and practical work.

Two articles (Chen et al., 2023; Liu et al., 2017) on the Vocational Education & Group Industrial Park Model argued that industrial parks provide a centralized industrialization platform for enterprises, which reduced the cost of cooperation and avoided the risks of the external market at the same time.

Research Involving School-Enterprise Cooperation Model

Among the seven articles (Chen et al., 2023; Gao & Wang, 2022; Liu et al., 2017; Qi et al., 2022; Wang & Gao, 2023; Zhou et al., 2022; Lin, 2023) of the Enterprise-led Model, two (Qi et al., 2022; Lin, 2023) discussed in Dual-Professional Teacher Training Model. One article (Lin, 2023) pointed out that by employing front-line technical elites from industrial enterprises to participate in teaching in schools, teachers' practical skills and practical teaching experience can be effectively enhanced. Through the incentives of dual post and dual salary, it could effectively stimulate the enthusiasm of teachers and enterprise engineers, thus enhancing the overall effect of internship training guidance (Qi et al., 2022).

Among the three articles (Wang & Gao, 2023; Zhou et al., 2022; Lin, 2023) on Joint Patent & Technology Development Model, one article (Lin, 2023) took the patent data of S-EC in Dalian as the object of study, and analyzed the patent application situation, technology composition, inventor ranking and distribution of patented technology fields. It showed that joint patent applications by schools and enterprises not only promote technological innovation, but also provide strong data support for S-EC to promote future development.

The School+Enterprise+Enterprise Model refers to a new type of S-EC model in which schools introduce third-party consulting service organizations to bridge the gap between the school and the enterprise and carry out reforms in professional construction. Article (Liu et al., 2017) pointed out that vocational schools were both the main body of school-enterprise-enterprise cooperation and the object to be served. This model was of great reference significance and popularization value for solving the common problems encountered by vocational schools in professional construction.

In the two articles (Chen et al., 2023; Gao & Wang, 2022) about the "School-in-Factory" & "Factory-in-School" Model, Chen et al., (2023) pointed out that this model not only served as an entry point for the reform of TVE, but also provided a new path to match the interests of the enterprise, the school and the students. However, although this model had demonstrated its unique advantages in practice, it still faced many difficulties and challenges in its implementation. In order to solve these problems, it’s necessary to establish a perfect faculty in order to increase the depth and breadth of cooperation, and at the same time, jointly set up a docking management organization, with clear responsibilities and assessment system, to ensure that S-EC was carried out efficiently and quickly.

V. DISCUSSION

This systematic literature review examined the current effective models of S-EC in China, covering 15 articles published over the past decade. At present, there are relatively few literature reviews on this topic in Chinese academia, and most of the studies talk about and analyze the models of S-EC, with not many systematic and summarizing studies. In this paper, through a systematic literature review of nine Chinese and seven English papers, three major

categories and ten sub-categories of effective S-EC models were identified.

The review suggests that either the School-led Model, the Enterprise-led Model or the School-Enterprise Cooperation Model will enhance the effectiveness of S-EC in China. At present, among the three main models of S-EC in China, the School-led Model remains the mainstream model and has the largest amount of relevant literature. The models that rely on schools to build workshops, laboratories and research centers, as well as related vocational qualifications and "1+X" certificates, exists in most of the S-EC programs. In addition, Orderly Cultivation Model and Vocational Education & Group Industrial Park Model can also rely on the industrial resources of enterprises to effectively improve the quality of talent cultivation and ensure the results of school-enterprise cooperation. As an emerging mode of S-EC, School+Enterprise+Enterprise Model has also begun to show its prominence in the current economic and social context. By building bridges between schools and related industries, service-oriented enterprises not only benefit themselves, but also provide a platform for in-depth exchanges between schools and related industries, which promotes effective cooperation between schools and enterprises.

VI. CONCLUSION

In summarizing and reviewing the literature, several limitations were founded. Firstly, most of the papers studying the effective mode of S-EC were qualitative studies, discussing the problems from the perspectives of schools and enterprises and putting forward opinions and suggestions, but they lacked innovative points. Secondly, there were fewer papers that discuss the issues from the perspective of all schools, enterprises and the government, however the important position of government cannot be ignored as an important guarantor of S-EC. Thirdly, there were fewer quantitative studies through data analysis, which failed to put forward reasonable evaluation criteria for the effectiveness of S-EC.

In future researches, more quantitative research should be used to support the effectiveness of S-EC with research data, and at the same time, combined with the government's policy measures, to develop and improve the evaluation criteria of the effectiveness of S-EC, and to carry out S-EC through more effective models.

In conclusion, S-EC can give full play to the respective advantages of schools and enterprises, jointly cultivate talents needed by society and the market, and help to strengthen the cooperation between schools and enterprises through the combination of teaching and production. Effective S-EC models allow schools and enterprises to support each other, interpenetrate each other, intervene in both directions, complement each other's strengths, use each other's resources, and share benefits, and it is an important way to realize the modernization of TVE, to promote the development of productive forces, and to make the sustainable development of education and production.

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Conflict Of Interest

The authors declare that there is no conflict of interest.

Authorship Contribution

Conceptualization: Huan Liang, Adnan Ahmad.

Project Management: Adnan Ahmad.

Writing - Original Draft: Huan Liang.

Writing - Proofreading and Editing: Huan Liang, Adnan Ahmad & Aqeel Khan

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