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Effectiveness of School-Enterprise Cooperation of Vocational Education Colleges in Zhengzhou City under Henan Province

Yuan Fang[1*], Somsak Chanphong[2], Sutida Howattanakul[3]

1 *Faculty of Education, Bangkokthonburi University, Thailand*
2 *Faculty of Education, Bangkokthonburi University, Thailand*
3 *Faculty of Education, Bangkokthonburi University, Thailand*
* *Corresponding author. E-mail:* dr.thiwat@gmail.com

Abstract

This study aimed to: (1) examine the components of effective school-enterprise cooperation in vocational education in Zhengzhou City, Henan Province; (2) develop a model of effectiveness for such cooperation in vocational education colleges; and (3) propose guidelines to enhance the effectiveness of school-enterprise collaboration. A mixed-methods approach was employed, combining in-depth interviews, structured questionnaires, and focus group discussions. The research subjects included 6,098 administrators and teachers from six representative vocational colleges and 55 management personnel from six enterprises in Zhengzhou City. Using stratified random sampling, 410 participants were selected to ensure broad representation. Additionally, nine key informants were purposefully chosen, and focus group discussions involved nine experts from both colleges and enterprises. Data were collected using a five-point Likert scale questionnaire, and descriptive statistics and confirmatory factor analysis (CFA) were conducted using statistical software. The results revealed that the effectiveness of school-enterprise cooperation comprised five components: school-enterprise coordination mechanism, resource allocation efficiency, depth of enterprise participation, effectiveness of students' practical teaching, and cooperation performance evaluation. CFA confirmed a model encompassing these five components with 58 specific indicators, demonstrating strong structural validity and consistency with empirical data. Based on the findings, five key guidelines were proposed: strengthening coordination mechanisms, optimizing resource integration, enhancing enterprise leadership, improving practical teaching quality, and establishing a scientific evaluation system. These guidelines provide theoretical support and practical pathways to enhance educational quality and deepen school-enterprise cooperation.

Keywords: School-Enterprise Cooperation, Vocational Education, Effectiveness Model, Zhengzhou City

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Introduction

China's higher vocational education has expanded rapidly over the past two decades. By 2022, there were 1,521 vocational colleges, including undergraduate-level institutions, accounting for 50.48% of all higher education institutions. (Hu, 2006). School-enterprise cooperation, evolving from the work-study integration model to the industry-education integration model, has become a core approach, linking enterprise resources with skilled talent development to enhance both educational quality and industrial service capacity. (Hu, 2009).

National policies have reinforced this cooperation. (Ministry of Education. 2022). Notable initiatives include the 2018 Measures to Promote School-Enterprise Cooperation, the 2020 modern industrial college programs, the 2022 revised Vocational Education Law, and directives from the 20th Party Congress, all of which emphasize its strategic importance. Despite these efforts, challenges remain, including shallow engagement, regional disparities, and limited participation by small and medium-sized enterprises (SMEs), which often prioritize short-term labor needs over long-term collaboration.

As China's economy transitions toward high-quality development, initiatives such as Made in China 2025 underscore the urgent need for skilled talent. (Wang, 2005). However, skilled workers constitute only 19% of the workforce, with high-skilled personnel representing merely 5%, highlighting a critical supply-demand gap. (Wu, al. et., 2015). Improving the effectiveness of school-enterprise cooperation is therefore essential for driving vocational education reform and supporting industrial upgrading.

This study investigates the effectiveness of school-enterprise cooperation in vocational education in Zhengzhou City, Henan Province. Theoretically, it addresses gaps in systematic research on effectiveness models and enriches the literature on vocational education in China. Practically, it encourages enterprises to take active roles in education, explores adaptive cooperation pathways, and provides guidance to improve talent quality and industrial service capacity.

Questions

1. What are the components of the effectiveness of school-enterprise cooperation in vocational education in Zhengzhou City, Henan Province?
2. What is the model for the effectiveness of school-enterprise cooperation in vocational education in Zhengzhou City, Henan Province?
3. How can guidelines be proposed to improve the effectiveness of school-enterprise cooperation for vocational education colleges in Zhengzhou City, Henan Province?

Objectives

1. To examine the components of the effectiveness of school-enterprise cooperation in vocational education in Zhengzhou City, Henan Province.
2. To develop a model for the effectiveness of school-enterprise cooperation in vocational education colleges in Zhengzhou City, Henan Province.
3. To propose guidelines to enhance the effectiveness of school-enterprise cooperation in vocational education in Zhengzhou City, Henan Province.

Literature Reviews

Under China's education modernization agenda, school-enterprise cooperation has become a strategic mechanism for aligning vocational education with industrial transformation. Particularly in Zhengzhou's vocational colleges, the push toward industry education integration

aims to balance educational supply with market demand. However, institutions often face persistent challenges: vague institutional responsibilities, limited resource allocation, uneven enterprise engagement, and inadequate evaluation systems (JianFeng, Worapongpat, 2024).In this environment, school-enterprise cooperation, rooted in resource integration and mutual benefit, has emerged as a core driver of high-quality vocational talent cultivation. (Makjod, al. et., 2025).

This study adopts a definition of school-enterprise cooperation as a competency-oriented, policy-guided collaborative framework jointly executed by vocational institutions and enterprises. (Pintong, Worapongpat, 2024). Its essential features include multi-stakeholder participation, process coordination, and feedback loops (Worapongpat, 2025). The mechanism is operationalized through co-developed curricula, shared training bases, faculty exchange, integrated internships, and employment pathways, with continuous evaluation ensuring optimization. Beyond skill acquisition, scholars emphasize its role in embedding enterprise culture into education to enhance students' professional values and identity (Worapongpat, 2025).

Vocational education, as a key segment of the national education system, not only produces applied and technical talent but also supports regional economic upgrading. It is fundamentally employment-oriented and competence-centered (Worapongpat, Arunyakanon, 2025), emphasizing practical training in authentic or simulated work environments (Worapongpat, Kangpheng, 2025). Modern perspectives extend their role to lifelong learning systems, integrating professional ethics, social responsibility, and legal governance frameworks (Worapongpat et al.,2023).

The effectiveness of cooperation is conceptualized as the aggregate outcome of collaborative mechanisms that achieve high-quality talent cultivation, efficient resource integration, and sustainable transformation through co-construction, co-responsibility, goal consensus, and cultural synergy (Worapongpat et al., 2023). Directly, practical cooperation aligns curriculum content, training standards, and industrial needs, while providing the resources and institutional stability necessary for long-term engagement. Indirectly, it stimulates student competencies through creativity development and strengthens adaptability via enhanced dynamic capability, defined as the ability to sense, seize, and reconfigure resources.

The current state of vocational education in Zhengzhou reflects pockets of excellence amid systemic weakness. (Worapongpat, Viphoouparakhot, 2024). While specific colleges have built exemplary enterprise partnerships, many remain constrained by funding shortages, inconsistent enterprise participation, and fragmented governance structures. In this context, the school-enterprise cooperation model, characterized by low capital intensity and high adaptability, demonstrates its unique value. By leveraging shared resources and fostering cultural alignment, it can enhance institutional resilience and better align graduate competencies with market expectations.

The significance of strengthening cooperation spans multiple dimensions. For institutions, it improves training quality, strengthens applied research capacity, and enhances competitiveness in talent and resource acquisition. (Xie, Ma, 2021). For students, it bridges the gap between classroom learning and workplace demands, fostering both technical proficiency and professional identity. For enterprises, it offers a sustainable talent pipeline and opportunities for collaborative innovation. For society, it contributes to regional economic growth, technological advancement, and employment stability. Academically, this study enriches the theoretical discourse on the effectiveness of cooperation, integrating perspectives from institutional economics, organizational synergy theory, and industry education integration.

These benefits rest on a robust theoretical foundation. Drawing on both domestic and international literature, the review traces the conceptual evolution, measurement dimensions, and operational mechanisms of school-enterprise cooperation, vocational education, cooperation effectiveness, and industry education integration. The framework synthesized here clarifies the direct impact pathways, resource empowerment, institutional alignment, and dual mediating mechanisms, creativity stimulation, and dynamic capability cultivation. This conceptual model provides the structural and theoretical basis for the empirical investigation that follows, enabling a comprehensive understanding of how cooperation mechanisms can be optimized to deliver high-value outcomes across educational, economic, and societal domains.

Methodology

This study employed a mixed-methods sequential design to investigate the effectiveness of school enterprise cooperation in vocational education colleges in Zhengzhou City, Henan Province.

For the quantitative component, the target population comprised 6,153 individuals, including college administrators, enterprise managers, and vocational education experts directly involved in cooperative initiatives. A stratified random sample of 410 participants was drawn, consisting of 362 college administrators and teachers and 48 enterprise managers, ensuring representativeness across institutions and enterprises.

For component identification, qualitative methods were used. A review of 12 relevant studies informed the development of preliminary indicators, which were then validated through in-depth semi-structured interviews with nine purposively selected key informants (six college administrators and three enterprise managers), each possessing substantial practical experience and theoretical expertise.

For model development, the literature-derived components and interview findings were integrated and refined through content analysis. Expert evaluation was employed to ensure theoretical alignment and practical applicability. For guideline formulation, an expert panel provided targeted feedback, ensuring that recommendations were contextually relevant to Zhengzhou's vocational education landscape.

Key variables, cooperation mechanisms, resource allocation efficiency, enterprise participation depth, student practical training effectiveness, and cooperation performance were operationalized using multiple strategies: (1) the Index of Item Objective Congruence (IOC) for content validation, (2) structured instruments for data collection, and (3) expert consultation for refinement.

Qualitative data were thematically analyzed, and model components were iteratively validated through expert review to ensure methodological rigor. Purposive sampling, multi-source data collection, and integration of both empirical and theoretical insights strengthened the study's validity and ensured applicability to the vocational education context of Zhengzhou City.

Results

1. The research findings on the components and indicators of effectiveness of school–enterprise cooperation in vocational education colleges in Zhengzhou City, Henan Province

The investigation surveyed 410 individuals, including faculty, administrative staff, and enterprise personnel (response rate: 100%), with a demographic analysis revealing balanced gender representation (55.12% male) and a predominant mid-career cohort (38.54% aged 36-45). The sample exhibited strong professional representation, with 79.27% being teaching faculty and 88.29% affiliated with vocational institutions. All observed variables demonstrated

acceptable univariate normality (absolute skewness < 2, kurtosis < 7), with means ranging from 2.98 to 4.22 across Likert-scale items, satisfying parametric analysis requirements.

2. The research findings of the model for the effectiveness of school-enterprise cooperation for vocational education colleges in Zhengzhou city, Henan Province

Confirmatory factor analysis established a five-construct measurement model with 5 components and 58 indicators：

School-Enterprise Coordination Mechanisms (SCM): Includes standardizing agreements, collaborative decision-making, and clear responsibilities (11 indicators).

Efficiency of Resource Allocation (ERA): Covers sharing of teaching staff, equipment utilization, and budget processes (12 indicators).

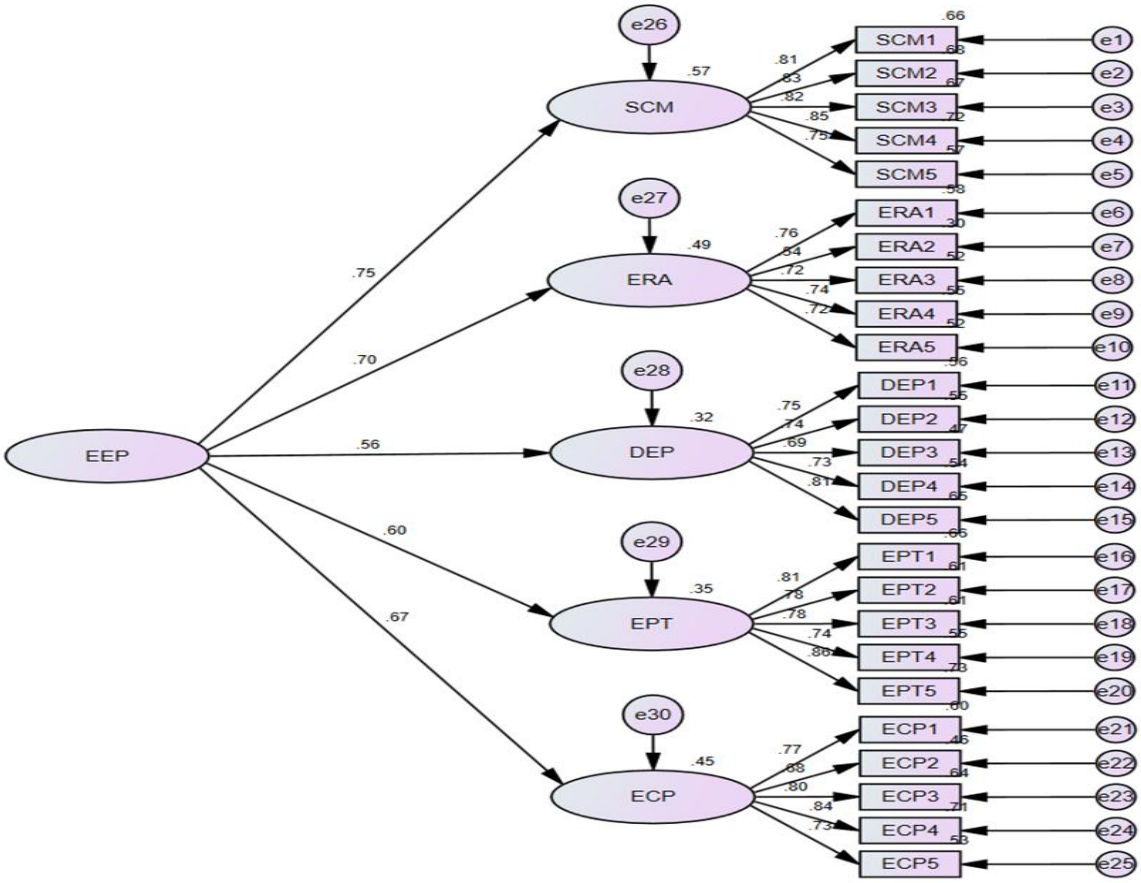
Depth of Enterprise Participation (DEP): Focuses on enterprise involvement in curriculum development, training, and talent evaluation (10 indicators).

Effectiveness of Student Practical Training (EPT): Assesses internship relevance, skill improvement, and student satisfaction (13 indicators).

Evaluation of Cooperation Performance (ECP): Measures employment quality, enterprise satisfaction, and feedback mechanisms (12 indicators).

The confirmatory factor analysis model and results are shown below:

Figure 1 Standardized Structural Diagram of Second-Order Confirmatory Factor Analysis



Chi-square=344.030 df.=270 CMIN/df.=1.274 n=410 CFI=0.986 NFI=0.938 GFI=0.937 IFI=0.986 RMSEA=0.026 RMR=0.026

Table 1 Factor loading coefficient table

Latent and observable	Factor loading		S.E.	Z-test	P	R^2	CR	AVE
	Unstandard	Standard						
SCM							0.907	0.660
SCM1<---SCM	1.000	0.811	-	-	-	0.658		
SCM2<---SCM	0.960	0.827	0.051	18.776	***	0.684		
SCM3<---SCM	0.977	0.821	0.053	18.598	***	0.674		
SCM4<---SCM	0.810	0.848	0.042	19.435	***	0.720		
SCM5<---SCM	0.790	0.753	0.048	16.55	***	0.567		
ERA							0.827	0.492
ERA1<---ERA	1.000	0.759	-	-	-	0.576		
ERA2<---ERA	0.681	0.544	0.067	10.187	***	0.296		
ERA3<---ERA	0.947	0.720	0.07	13.539	***	0.518		
ERA4<---ERA	0.896	0.740	0.064	13.905	***	0.548		
ERA5<---ERA	0.736	0.721	0.054	13.566	***	0.520		
DEP							0.861	0.556
DEP1<---DEP	1.000	0.751	-	-	-	0.564		
DEP2<---DEP	0.983	0.740	0.069	14.209	***	0.547		
DEP3<---DEP	0.869	0.688	0.066	13.192	***	0.474		
DEP4<---DEP	0.969	0.732	0.069	14.056	***	0.536		
DEP5<---DEP	0.810	0.808	0.052	15.483	***	0.653		
EPT							0.896	0.633
EPT1<---EPT	1.000	0.815	-	-	-	0.664		
EPT2<---EPT	0.919	0.778	0.054	17.163	***	0.605		
EPT3<---EPT	0.942	0.784	0.054	17.342	***	0.615		
EPT4<---EPT	0.952	0.740	0.059	16.064	***	0.547		
EPT5<---EPT	0.853	0.855	0.044	19.415	***	0.731		
ECP							0.876	0.588
ECP1<---ECP	1.000	0.775	-	-	-	0.600		
ECP2<---ECP	0.817	0.680	0.06	13.649	***	0.462		
ECP3<---ECP	0.933	0.800	0.057	16.408	***	0.64		
ECP4<---ECP	0.931	0.840	0.054	17.291	***	0.706		
ECP5<---ECP	0.902	0.728	0.061	14.755	***	0.530		

All five latent variables (SCM, ERA, DEP, EPT, and ECP) exhibit high standardized factor loadings on their respective observed indicators, with most exceeding 0.7, indicating that each item effectively represents its underlying construct. Among them, SCM and EPT exhibit robust convergent validity, with Composite Reliability (CR) values of 0.907 and 0.896,

respectively, and AVE values both exceeding 0.6, reflecting good internal consistency and explanatory power. In contrast, ERA's AVE is slightly below the 0.5 threshold at 0.492, but its CR is 0.827, which remains within an acceptable reliability range. All Z-values are statistically significant, with p-values marked as "***", confirming the presence of strong positive relationships among indicators and supporting the validity of the measurement model.

Table 2 Fitting index of the confirmatory factor analysis model

Common indicators	Judgment criteria	value	Standard or not
Chi-square	>0	344.030	fit
CMIN/DF	<3	1.274	fit
GFI	>0.9	0.937	excellent
AGFI	>0.9	0.924	fit
RMR	<0.03	0.026	fit
RMSEA	<0.03	0.026	fit
CFI	>0.9	0.986	excellent
NFI	>0.9	0.938	excellent
TLI	>0.9	0.984	excellent
PGFI	>0.7	0.778	fit
PNFI	>0.7	0.844	fit
PCFI	>0.7	0.887	fit
IFI	>0.9	0.986	excellent
p-value	<0.001	***	excellent

The confirmatory factor analysis (CFA) model demonstrates a strong overall fit and meets statistical expectations across multiple key indices. The chi-square value of 344.030, although influenced by sample size, remains within an acceptable range, while the CMIN/DF ratio of 1.274 is well below the threshold of 3, indicating a compact model structure with tolerable error levels. The GFI and AGFI values, recorded at 0.937 and 0.924, respectively, both exceed the recommended cutoff of 0.9, reflecting a high degree of model-data congruence. Moreover, the Root Mean Square Residual (RMR) stands at 0.026, which, though slightly above the strictest benchmark, remains within acceptable limits; the RMSEA also matches this value, placing the model in the marginally excellent zone of fit quality. Fit indices such as CFI (0.986), NFI (0.938), TLI (0.984), and IFI (0.986) all substantially surpass the 0.9 criterion, indicating that the model offers strong explanatory power and accurately represents the hypothesized factor structure. Additionally, parsimony-based indices PGFI (0.778), PNFI (0.844), and PCFI (0.887) all exceed the standard value of 0.7, suggesting a well-balanced model in terms of simplicity and goodness of fit. It is also worth noting that the p-value is less than 0.001 and is marked with "***", indicating strong statistical significance and the absence of major structural misfit.

3. The research findings on the development of guidelines for the effectiveness of school–enterprise cooperation in vocational education colleges in Zhengzhou City, Henan Province

Through focus groups with administrators and industry experts, this study identified three major barriers to effective cooperation: weak coordination mechanisms, inefficient resource sharing, and limited enterprise engagement. The research highlights two improvement pathways: (1) strengthening institutional frameworks (e.g., standardized agreements, digital

platforms) to boost operational efficiency; and (2) deepening enterprise participation to enhance training quality.

Implementation strategy for short-term is to launch coordination platforms and resource-sharing systems and for long-term is to establish policy mandates and third-party evaluation mechanisms

This framework provides a phased approach to transform vocational education-industry collaboration in Zhengzhou, balancing quick wins with sustainable reform.

Discussion

1. Components of School-Enterprise Cooperation Effectiveness (Objective 1). The study identified five core components of the effectiveness of school-enterprise cooperation in Zhengzhou's vocational education colleges: coordination mechanisms, resource allocation efficiency, enterprise participation depth, practical training effectiveness, and performance evaluation systems. These components, supported by 58 specific indicators, provide a comprehensive framework for assessing the quality and outcomes of cooperation. Collectively, these components integrate institutional, resource, and operational factors, offering a holistic perspective on effectiveness. Their alignment with prior research validates the theoretical robustness of the framework while highlighting contextual nuances, such as Zhengzhou's industrial demands and local vocational education policies.

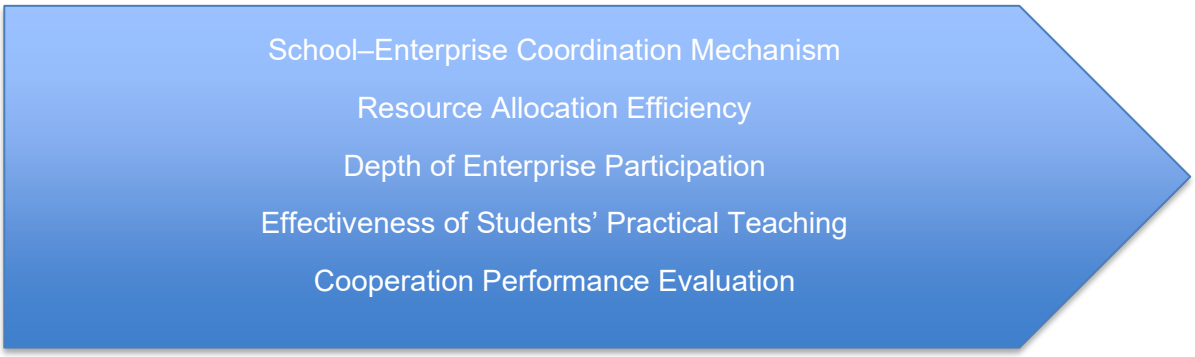
2. Structural Model Validation (Objective 2). The second-order confirmatory factor analysis (CFA) demonstrated excellent fit (CMIN/DF = 1.274, CFI = 0.986), confirming the validity of the five-component structure. Among the components, school-enterprise coordination (path weight: 0.75) was the most influential, consistent with the findings of Andrés Frik & Wirz (Byerly, 2013). who emphasized the use of contractual standards to reduce transactional risks. Resource allocation efficiency (0.70) reflected progress in shared resources but revealed financial tensions, aligning with Bourdieu and Wacquant's (1998) critique of incentive asymmetry. Enterprise participation depth (0.56) indicated lingering challenges, echoing concerns regarding insufficient corporate motivation. Practical training effectiveness (0.60) showed consensus on skill gains but uneven satisfaction levels, supporting warnings about course-job misalignment. Performance evaluation (0.67) highlighted the importance of multi-metric feedback, consistent with Chen (2018). stakeholder-social-contract framework. The model's statistical reliability and conceptual coherence extend (Chen & Liu, 2017). four-dimensional prototype, offering a transferable benchmark for policy and practice. Its empirical grounding in Zhengzhou ensures relevance for local stakeholders while providing a framework adaptable to broader contexts.

3. Guidelines for Improvement (Objective 3). Guidelines derived from focus groups and empirical findings address five strategic domains: collaborative governance, resource integration, enterprise engagement, training enhancement, and performance feedback. Collaborative governance emphasizes standardized agreements and goal alignment, echoing Chen (2008) on procedural trust. Resource integration advocates shared faculty and equipment, supported by a cost-benefit perspective. Performance feedback focuses on employment outcomes and enterprise satisfaction, aligning with Fang (2011). social-contract approach.Enterprise engagement guidelines, informed by (Han, 2011). The revenue-sharing model proposes incentives to encourage deeper corporate participation. Training enhancement emphasizes project-based learning and digital tools, reflecting apprenticeship research by These measures align with China's Vocational Education Law and the Ministry of Education's 2022 directives, ensuring coherence with policy. The systemic design of these guidelines integrates institutional, operational, and evaluative dimensions, addressing Zhengzhou's specific challenges while offering scalable solutions. Their foundation in the study's identified

components and validated model ensures both theoretical consistency and practical feasibility, effectively bridging research and policy implementation.

Originality

From the study entitled "Effectiveness of School-Enterprise Cooperation of Vocational Education Colleges in Zhengzhou City under Henan Province", new knowledge was discovered and synthesized into the "Effective School-Enterprise Cooperation Model", as follows:



Core Components of the ModelEffective School-Enterprise Cooperation consists of five main components and 58 specific indicators, as follows:

1. School–Enterprise Coordination Mechanism Establishment of joint coordination committees

Effective communication systems Clearly defined roles and responsibilities

2. Resource Allocation Efficiency Shared utilization of teaching and learning resources Financial and technological support from enterprises Exchange of teachers and personnel between schools and enterprises

3. Depth of Enterprise Participation Enterprise involvement in curriculum design Participation in practical teaching Provision of internship and employment opportunities for students

4. Effectiveness of Students' Practical Teaching Development of professional skills Readiness for employment Learning through real-world experiences in enterprises

4. Cooperation Performance Evaluation Monitoring and follow-up systems for cooperation Evaluation of project outcomes and achievements Application of evaluation results for continuous improvement

Recommendations

There are recommendations for applying the research results and for future research as follows:

Recommendations for Applying the Research Findings

1. Recommendations for Policy Formulation

Develop a municipal-level Vocational Education Coordination Ordinance to legally embed five effectiveness domain coordination, resource efficiency, enterprise engagement depth, training quality, and performance feedback—into the annual budget cycle. Vocational colleges and partner enterprises must publish audited progress indicators to access public funds or tax incentives, shifting subsidies toward outcome-based allocation. Establish a tripartite

governance structure (municipal education bureau, industry associations, labor unions) with veto power over high-value cooperation projects to prevent unilateral dominance, balance bargaining power, and implement Bourdieu's field-specific power redistribution. Introduce a graded tax credit system rewarding enterprises for escalating participation (from curriculum co-design to dual-teacher deployment and innovation studio funding), with sunset clauses invalidating credits if employment quality, patents, or revenue targets are unmet within three years. Create a provincial revolving fund for shared training infrastructure (XR labs, digital twins) by earmarking two units per mile from existing industrial levies, enabling colleges to access equipment via time-sliced leases and supporting cross-college utilization audits integrated into the city's innovative finance system. Mandate vocational institutions to sign an "open data covenant" publishing quarterly anonymized employment trajectories, salary medians, and employer satisfaction, aligned with Ministry of Education accreditation standards to enhance transparency. Empower trade associations to issue occupation-specific micro-credentials linked to the national qualification framework, restricting delivery to validated school-enterprise partnerships to curb unaccredited certificate fragmentation. Launch a policy sandbox with regulators, researchers, and enterprises testing dynamic tuition-sharing and AI mentoring, shortening feedback loops for evidence-based ordinance revisions.

2. Recommendations for Practical Application

Deploy a cloud-based "collaboration cockpit" to synchronize project timelines, resource bookings, and progress dashboards, triggering alerts for equipment/mentor conflicts to resolve double-booking issues. Form cross-functional teams (curriculum experts, engineers, HR strategists) to convert industry trends into modular learning packages, updating competency matrices every 8 weeks to avoid syllabus obsolescence. Implement dual-advisor systems pairing students with academic and enterprise mentors, using AI logs to track soft skills, technical proficiency, and resilience longitudinally, replacing end-of-term appraisals. Establish on-campus "micro-factories" where enterprises rotate small-batch production, exposing students to real client demands, quality KPIs, and cost pressures to bridge the gap with actual workplace conditions. Institutionalize annual 4-week "reverse internships" for teachers in partner firms, feeding observations into course redesign to ensure teaching methods keep pace with technological upgrades. Use blockchain to record practical tasks and assessments, enabling graduates to present verifiable skill passports and enterprises to access tamper-proof training ROI data. Create a municipal-moderated forum for faculty, enterprise supervisors, and students to share troubleshooting cases, with minutes populating a centralized knowledge base to replace ad hoc communication. Pilot revenue-sharing for co-developed patents/processes, distribute royalties among colleges, student teams, and enterprises to fund further collaboration and foster innovation.

Recommendations for Future Research

Based on this research foundation and current trends in educational innovation domestically and internationally, future research directions and specific project topics will continue to focus on deepening leadership capabilities, empowering technology, and adapting policies in scientific research teams at private universities. Researchers may explore the following directions:

1. Study of the impact of policy incentives on the depth of school-enterprise cooperation of vocational education colleges in Zhengzhou city under Henan Province

2. Research and Development of an Evaluation Index System for the Effectiveness of School-Enterprise Cooperation of vocational education colleges in Zhengzhou city under Henan Province

3. Study of the Barriers to Cross-Industry School-Enterprise Cooperation of vocational education colleges in Zhengzhou city under Henan Province

4. Research and Development of a Smart Platform for Promoting School-Enterprise Cooperation for Vocational Education

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