

Theoretical and Empirical Research on Improving the Quality of Higher Vocational College Enterprise Cooperation Based on PDCA Cycle

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Abstract. The quality of school enterprise cooperation in vocational colleges is one of the important indicators for the quality of teaching practice in vocational colleges. Applying project management methods, technologies, and tools to school enterprise cooperation construction projects has significant advantages, which helps to ensure the quality of school enterprise cooperation construction projects under the "Double High Plan". In this context, this article takes the construction project of the School of Finance and Economics Cooperation of Chengdu Vocational and Technical College as the research object, applies the PDCA cycle improvement theory of project quality management to the school enterprise cooperation of the School of Finance and Economics, analyzes the problems in the construction of the school enterprise cooperation project of the School of Finance and Economics, and proposes improvement suggestions, in order to explore an effective path for higher vocational colleges in finance and economics to promote the quality improvement of school enterprise cooperation projects.

1. Introduction

In recent years, the government has vigorously supported vocational education, and exploring ways to enhance school enterprise cooperation is the key to promoting the implementation of relevant policies and improving higher vocational education. School enterprise cooperation is a talent cultivation model that emphasizes the collaborative cooperation between schools and enterprises, emphasizes the quality of talent cultivation, emphasizes students' learning and enterprise practice in school, and shares resources and information between schools and enterprises. School enterprise cooperation is not only a key focus of current education reform and development, but also a difficult and key point for vocational colleges to improve the quality of teaching practice and create unique features. It is also one of the key contents to be completed in the "Double High Plan". The "integration of industry, education, and research" model in school enterprise cooperation is a product of changes in market demand and continuous adjustment of industrial structure. It is proposed that the purpose of industry education integration is to improve the participation of industry enterprises in running schools, comprehensively promote school enterprise collaborative education, and promote the overall formation of a development pattern of education and industry integration and benign interaction. This model requires deep integration between schools and enterprises in the implementation of theoretical and practical courses, strengthens mutually beneficial cooperative relationships, improves students' professional

knowledge and practical abilities, and will become the mainstream model of school enterprise cooperation.

2. The Current Situation and Problems of School Enterprise Cooperation in Financial Vocational Colleges

Financial vocational colleges are increasingly valuing school enterprise cooperation and have a high level of overall participation, but financial school enterprise cooperation

The results were not satisfactory. Due to the strong confidentiality of financial positions and doubts about the professional competence of vocational students, the participation of enterprises in school enterprise cooperation is not high. The depth and breadth of school enterprise cooperation in financial vocational colleges are not enough, and the overall level is at a relatively low level. In addition, after specifying the mode of school enterprise cooperation, the lack of specific operations on how to cooperate and what specific things to cooperate has led to a lack of cooperation norms, or the mode of school enterprise cooperation is superficial and only involves some simple cooperation. At present, vocational colleges in finance and economics are not attractive enough for industry enterprises to participate in deep level cooperation, often due to their own lack of strength, and their advantages in attracting enterprises to participate in cooperation are not obvious. Most financial vocational colleges do not establish a school enterprise cooperation committee or a communication and

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exchange platform, and there are few opportunities for online and offline communication and exchange between personnel participating in cooperation between schools and enterprises[1]. Therefore, it is difficult to carry out school enterprise cooperation at a deeper level, and it is difficult to communicate and explore important issues related to in-depth school enterprise cooperation

3. Construction of PDCA for School Enterprise Cooperation in Financial Vocational Colleges

The PDCA cycle is an important program in project management. The PDCA cycle was proposed by the founder of modern management, American Hugh Hart, and introduced to Japan by the management master Deming. Therefore, the PDCA cycle is also known as the Deming cycle, which includes four recurring stages of continuous diagnosis, continuous improvement, and spiral rise, including Plan, Do, Check, and Act. Under the premise of standardization, the continuous improvement spiral achieves closed-loop management of projects through the cycle of each link[2].

This study applies the PDCA theory to the management system of school enterprise cooperation in higher vocational colleges of finance and economics. By continuously identifying and solving problems, improving school enterprise cooperation management, and realizing the role of optimizing school enterprise cooperation management, the school enterprise cooperation can be optimized in the long term and continuously improved and upgraded according to economic development and enterprise needs

3.1. Planning Stage - Initial Goal Setting (P Stage)

Every academic year, financial vocational colleges develop effective school enterprise cooperation plans based on the school's work plan, combined with the college's enrollment situation and changes in enterprise demand. At the same time as specifying the school enterprise cooperation plan, it is also necessary to develop corresponding assessment plans to ensure that the school enterprise cooperation plan is practical and feasible, and to facilitate the assessment of the completion of the school enterprise cooperation plan during the academic year.

3.2. Execution Phase - Implementation Support (Phase D)

In the implementation part, financial vocational colleges carry out relevant work according to the school enterprise cooperation plan. The person in charge of school enterprise cooperation needs to further clarify their job responsibilities, specific division of labor, be responsible for organizing the implementation of various plans and quality management work, and supervise relevant personnel to complete corresponding tasks on time and in quantity according to the school enterprise cooperation

plan. On the other hand, the school administrative department provides corresponding human resources and resources for task completion, ensuring the smooth progress of school enterprise cooperation work.

3.3. Inspection Phase - Process Monitoring (Phase C)

Process monitoring is the supervision and evaluation of school enterprise cooperation work. In the specific implementation of school enterprise cooperation, financial vocational colleges can collect information on school enterprise cooperation work through multiple evaluations such as student evaluation, enterprise evaluation, and social evaluation, achieving the goal of supervising school enterprise cooperation tasks[3]. Supervise and evaluate the execution and completion of school enterprise cooperation work from all aspects and perspectives.

3.4. Summary Phase - Optimization and Improvement (Phase A)

At the end of each year, the person in charge of school enterprise cooperation should summarize the completion status of school enterprise cooperation this academic year, promote measures with significant results, improve deficiencies, analyze the reasons for problems, and form an analysis report. For the problems that cannot be solved this year, they will be included in the new round of PDCA cycle. Through analysis and diagnosis, we will further improve the quality management of school enterprise cooperation.

4. Taking the School of Finance and Economics of Chengdu Vocational College as an example to demonstrate the PDCA cycle promoting the improvement of school enterprise cooperation

According to the theory of PDCA, the quality management of school enterprise cooperation is achieved through cyclic and dynamic improvement, achieving a spiral increase in the quality of school enterprise cooperation, continuously improving the quality of school enterprise cooperation, and thus enhancing the quality of school enterprise cooperation. Through the PDCA cycle, the quality management level of school enterprise cooperation is continuously improved. Taking the School of Finance and Economics of Chengdu Vocational College as an example, this article demonstrates the practical application of the PDCA cycle in school enterprise cooperation.

Since its establishment, the School of Finance and Economics has been actively exploring new methods and reform methods for school enterprise cooperation, but there are still many areas for improvement in school enterprise cooperation. In 2019, Chengdu Vocational and Technical College carried out the "Double High"

construction. Compared with the construction requirements, the school enterprise cooperation project utilized the PDCA cycle, strengthened the quality management of school enterprise cooperation projects, enhanced the quality control of school enterprise cooperation, continuously optimized the school

enterprise cooperation management system, and achieved the goal of achieving the "Double High Plan" school enterprise cooperation project construction. The school enterprise cooperation of the School of Finance and Economics continuously improved the PDCA cycle, as shown in Fig.1.

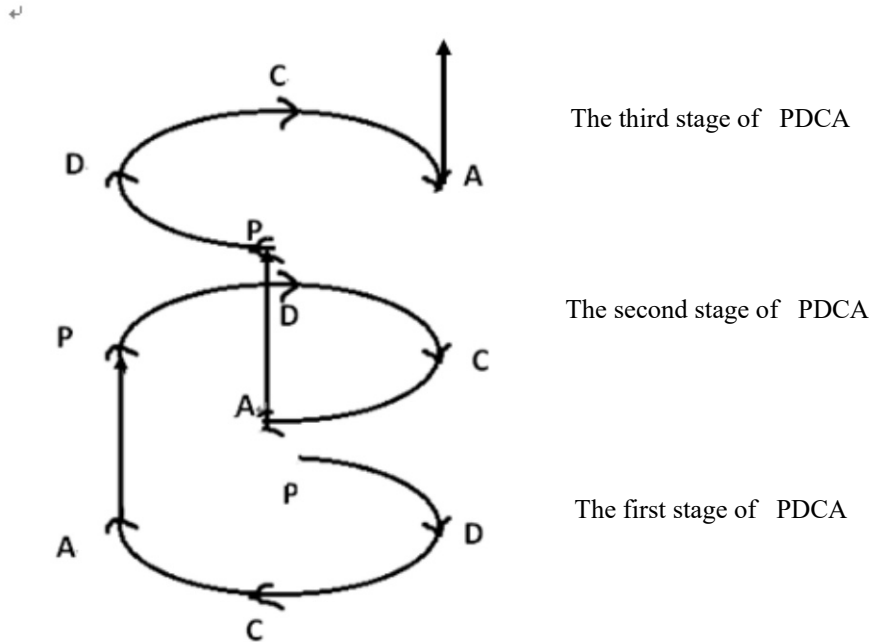


Fig. 1. PDCA cycle of school enterprise cooperation in the School of Finance and Economics.

4.1. Optimize organizational structure (Phase P)

The specific work functions of school enterprise cooperation are under the jurisdiction of the Teaching Office of the School of Finance and Economics, and are the overall responsibility of the Dean of Teaching of the School. With the continuous improvement of the requirements of the "Double High Plan", tasks will be assigned to specific responsible personnel. The leaders of each major have become the secondary leaders of the School of Finance and Economics' school enterprise cooperation projects, responsible for the school enterprise cooperation plans of each major. Each secondary leader has three levels of leaders responsible for the execution and communication of specific school enterprise cooperation projects for each major.

4.2. Develop a school enterprise cooperation plan (Phase D)

The School of Finance and Economics carefully analyzes the spirit of the relevant documents of the "Double High Plan", actively visits financial and accounting enterprises in the city where they are located, understands the needs of enterprises, formulates the "Construction Plan for School Enterprise Cooperation Projects", and scientifically proposes quality management requirements such as expected goals and acceptance points for school enterprise cooperation projects. The relevant acceptance points are shown in Table 1:

Table 1. Key Construction Plan for Acceptance of School Enterprise Cooperation Projects.

Secondary indicators	Third level indicators	Key points of acceptance
Digital Upgrade of Training Base	Construction of Training Base	1. 2 new cooperative enterprises or institutions for each major
		2. Add 4 off campus training bases
		3. Building four ideological and political education bases for courses
	Professional upgrading and digital transformation	1. 30 professional teachers trained in big data
	2. Building a digital intelligence training platform	
	3. 5 digital school-based textbooks	
	4. Apply for 20 patents and soft works	
Social services	Creating a distinctive cultural center to serve the public	1. Creating distinctive cultural experience centers for various majors
		2. Offering professional and characteristic cultural lectures

	Enterprise training and undertaking competitions	1. 350 training sessions per year for enterprises 2. Undertake 2-3 provincial and industry vocational skills competitions
Building a teaching staff	Enhancing the Social Practice Ability of Professional Teachers	1. 4 teachers studying in enterprises 2. Double teacher quality ratio reaches 90% 3. 3 awards won in the provincial teacher ability competition
	Professional teacher training	1. Introduce 1-2 professional leading talents 2. Cultivate 3 doctoral students 3. Train 6 backbone teachers
	Enterprise experts entering school	1. Building a part-time teacher resource library with a capacity of 50 people 2. 20 Enterprise Experts Entered Classroom
	Student Employment Competitiveness	1. 1+X certificate assessment pass rate exceeding 80% 2. Cultivate no less than 50 modern apprenticeship students
Student Employment Analysis	Student employment situation	1. Maintain initial employment rate above 95% 2. Employers have a satisfaction rate of over 98%
	Overseas communication	1. Train 8 bilingual teachers 2. Encourage 20 students to participate in overseas exchange activities

4.3. Implement the school enterprise cooperation management plan (Phase D)

According to the acceptance points determined in Phase P, the project team will be convened to clarify the responsible parties for the acceptance points. Confirmation will be made on whether the acceptance points meet the standards, and arrangements will be made for project progress. Integrate the "Double High Plan" school enterprise cooperation construction project with the daily work of the School of Finance and Economics, write the acceptance points into the annual work plans of each major, and summarize them every year. Establish and implement a project reporting and scheduling system, and hold monthly project scheduling meetings. At the meeting, the person in charge of the acceptance points introduced the progress situation. For projects that progress slowly, the leaders of the School of Finance and Economics personally supervised them, analyzed the project constraints, and proposed a change plan to the project leader if there were indeed objective reasons that could affect the completion of the acceptance points[4].

4.4. Conduct project quality review (Phase C)

Table 2. Risk points for acceptance of school enterprise cooperation projects.

Digital Upgrade of Training Base	Professional upgrading and digital transformation	1. Professional Teacher Big Data Training for 30 People
		2. 5 digital school-based textbooks

Invite well-known domestic vocational education experts to review the professional upgrading and digital transformation modules of the school enterprise cooperation project. Through on-site evaluation, data review, and interviews, problems in the professional

upgrading and digital transformation modules were found. Through research, it was found that the number of professional teachers trained in big data and the number of completed digital school-based textbooks for professional upgrading and digital transformation projects did not meet the requirements. Experts believe that there are risks in achieving these two indicators in professional upgrading and digital transformation projects, as shown in Table 2.

In addition, some experts pointed out that it is best for each major to establish a digital intelligence training platform that can achieve the function of information sharing throughout the entire college, and to build a digital intelligence training platform that can be shared. Experts also suggest that while applying for patents and software works, we should also work with corresponding enterprises to research and transform the results of patents, achieving the integration of industry, academia, and research.

4.5. Project Quality Management Work Evaluation (Phase A)

After the first phase of the PDCA cycle, the school enterprise cooperation project of the School of Finance and Economics has basically completed the expected goals according to the schedule, creating an excellent dual teacher quality teacher team that flows both inside and outside the school, building a multi module professional resource library, and enhancing the reputation of the school by holding vocational skills competitions. We have built a financial culture education experience hall and carried out various forms of characteristic activities. According to the latest teaching requirements, we will focus on the application of new technologies such as big data, artificial intelligence, cloud computing, and blockchain in the field of finance and economics. We will jointly build 5 on campus

training bases and 10 off campus training bases, jointly develop 6 professional courses, and have a professional group enterprise part-time teacher library. The project team will strengthen and improve the issues identified in the first phase of PDCA in the subsequent quality management PDCA cycle.

4.6. Phase 2 PDCA cycle

In response to the insufficient number of big data training for professional teachers and the insufficient construction of digital school-based textbooks discovered in the first phase of the PDCA cycle, the school enterprise cooperation project team requested guidance from the leadership group to adjust the quality policy in a timely manner, optimize quality control methods, and improve the quality level of school enterprise cooperation projects.

(1) Problem Discovery and Cause Analysis (Phase P)

Through the PDCA cycle in the first stage, it was found that the school enterprise cooperation project of the School of Finance and Economics has the following problems: Firstly, the number of professional teachers receiving big data training did not meet the requirements, and secondly, the number of completed digital school-based textbooks did not meet the requirements. Thirdly, there is a lack of shared digital and intelligent training platforms.

Reason analysis: Firstly, due to the lack of qualitative requirements for professional teachers in conducting training work, and some teachers' insufficient understanding of the importance of big data technology, the training willingness of teachers is not strong. Additionally, there is no corresponding incentive policy for teachers who actively participate in training. Secondly, the School of Finance and Economics only has specific planning data for the construction of digital school-based textbooks, but has not planned the specific textbooks for specific personnel. Thirdly, there is a lack of a data platform for overall planning.

(2) Propose Quality Control Corrective Opinions (Phase P)

In response to the problems discovered during the P stage, the school enterprise cooperation project team invited relevant personnel from the Municipal Foreign Affairs Office, as well as the school's academic affairs, personnel, and school enterprise cooperation departments to hold a seminar and propose quality control and correction suggestions for the existing problems. The specific opinions are shown in Table 3:

Table 3. Risk points for acceptance of school enterprise cooperation projects.

Serial number	Problem Description	Quality improvement suggestions
1	The number of professional teachers trained in big data did not meet the requirements	The branch leaders held a meeting with key teachers, emphasizing the importance of learning big data and cutting-edge financial information technology skills, and organized and arranged for key and young teachers to start big data training.

2	The number of completed digital school-based textbooks does not meet the requirements	The task of digitizing school-based textbooks will be divided into course groups for each course, led by professors or doctoral students and composed of backbone teachers and enterprise teachers. Each course group will carry out the development plan of digital school-based textbooks in an orderly manner.
3	Build a shared digital intelligence training platform	By updating the project of the Financial Culture Education Experience Hall, upgrading the information network facilities of the training base, enhancing the digitalization and intelligence level of the school enterprise cooperation training base, and creating an open and shared smart training base that integrates new technologies and skills.

(3) Implement quality control corrective measures (Phase D)

One is to revise the method for determining the workload of continuing education teachers and submit it to the leadership group of the institute. The leadership group will give a certain amount of workload recognition to teachers with excellent continuing education performance, fully mobilizing the enthusiasm of teachers to participate in the training.

The second is to link the completion of digital school-based textbooks with final performance, and give certain performance rewards to the project teams that have completed well. The project teams are led by teachers with high professional titles and high education, and are equipped with backbone teachers and enterprise teachers, fully leveraging the role of school enterprise cooperation.

Thirdly, by updating the project of the Financial Culture Education Experience Hall, upgrading the information network facilities of the training base, enhancing the digitalization and intelligence level of the school enterprise cooperation training base, and creating an open and shared smart training base that integrates new technologies and skills.

(4) Quality Control System Effectiveness Inspection and Evaluation (Phase C)

Through joint inspections organized by the school professor committee, teaching supervision room, and other organizations, the problems that occurred in the first stage were resolved in the PDCA cycle in the second stage. Through a survey questionnaire, it was found that there is a problem of "some school enterprise cooperation enterprises not cooperating deeply enough" in the promotion of school enterprise cooperation projects.

(5) Summary and Improvement of Quality Control Measures (Phase A)

Through the second phase of the PDCA cycle, the school enterprise cooperation project has achieved

significant results. We jointly build and share 10 school enterprise cooperation enterprises and off campus training bases, jointly develop 6 professional courses, and have a professional group enterprise part-time teacher library that can be shared in school enterprise cooperation, course construction, training bases, and full-time and part-time teachers. For the issue of insufficient depth in cooperation between some school enterprise cooperation enterprises discovered in the second stage of PDCA, the project team will continue to adopt quality management concepts, methods, and tools in the third stage of PDCA cycle, strengthen quality control, solve problems, and comprehensively improve the quality level of school enterprise cooperation.

4.7. Preliminary ideas for the third stage PDCA cycle

The school enterprise cooperation project of the Finance and Economics Branch has gone through the first two stages of the PDCA cycle and basically achieved the expected goals. In 2020, the college was awarded the title of Sichuan High Level Professional Group. In the third stage of the PDCA cycle, address the issues identified in the second stage of the PDCA cycle. The School of Finance and Economics plans to be rooted in the Chengdu Financial City and collaborate deeply with enterprises such as Bank of Chengdu, Chengdu Financial Dream Factory, Bosch Group Chengdu Financial Sharing Center, China Ping An, China Life Insurance, West China Securities, etc., continuously exploring the integration mechanism of "city school enterprise" industry education integration. We plan to jointly carry out a series of work such as enterprise new product research and development, enterprise technical standard formulation, enterprise employee training, implementation of vocational financial talent training system, and assessment. We plan to establish a Chengdu Financial Technology Achievement Research and Transformation Center, accelerate the innovative application of blockchain and other technologies in financial scenarios, promote the transformation of school research achievements into enterprise applications, and strive to enhance the ability of financial services to the real economy[5].

5. Evaluation of the effectiveness of quality management improvement

5.1. High standard completion of various indicators for school enterprise cooperation projects

The implementation of school enterprise cooperation construction projects has greatly improved the educational strength and level of the School of Finance and Economics. Based on the PDCA theory, the quality management of school enterprise cooperation projects has been improved, and the school enterprise cooperation

construction projects have steadily advanced, achieving a series of results. During the project period, the School of Finance and Economics achieved landmark results in 5 national and 26 provincial levels, with each major quantitative indicator exceeding the target value and exceeding the construction task.

5.2. Recognition of the effectiveness of high-quality school project construction

The School of Finance and Economics is a locally owned public higher vocational college. Serving local governments and industry enterprises is the purpose and mission of the school's governance, and it is the fundamental value of the school's existence and development. The School of Finance and Economics was awarded the title of Advanced Collective in 2019, and in recent years, the school's assessment level has been excellent. By deepening the integration of industry and education, encouraging the active development of modern apprenticeship systems and various school enterprise cooperative education models in accordance with professional characteristics, aligning professional standards, industry standards, and job norms, and jointly developing a curriculum system and teaching resource library based on actual work processes by schools and enterprises, carrying out pilot construction of the "1+X" certificate system, and improving the level of financial technology professional talent cultivation; Relying on the resources of the group, we will strengthen the two-way exchange and sharing of talents between schools and enterprises, and provide high-quality talent resource support for the sustainable development of fintech through joint enrollment and training of in-service personnel between schools and enterprises.

6. Improvement Path of Quality Management in School Enterprise Cooperation Based on PDCA Cycle Theory

6.1. Standardization of school enterprise cooperation system

As school enterprise cooperation is one of the important teaching practice links for vocational colleges, it is necessary to develop a systematic and standardized management method for school enterprise cooperation. On the one hand, functional departments of financial vocational colleges can coordinate and supervise the quality of school enterprise cooperation. On the other hand, administrative departments need to develop management systems for school enterprise cooperation tailored to local conditions, forming a complete management system for school enterprise cooperation, which can achieve overall improvement of the quality and level of school enterprise cooperation.

6.2. Information management of school enterprise cooperation

In the era of rapid development of information technology, scientific and effective use of modern means to manage school enterprise cooperation with high quality and effectiveness. On the one hand, the quality management of school enterprise cooperation is a dynamic and long-term process. Establishing a management information system can facilitate the establishment of a good and safe communication mechanism between schools and enterprises, improve the strength of school enterprise cooperation communication, and standardize management.

6.3. Real time supervision and feedback on school enterprise cooperation

The "Double High Plan" group established by the school can supervise the cooperation between the school and the enterprise. On the one hand, the members of the "Double High Plan" team should actively play their role by sorting and summarizing the results of various inspections, proposing corresponding solutions to the problems that arise during the inspection process, forming a systematic report, and promptly providing feedback to the corresponding person in charge of school enterprise cooperation; On the other hand, for school enterprise cooperation issues discovered during the inspection process, the second and third level leaders should actively cooperate, promptly verify, form a rectification plan, carry out rectification, and feedback the results to the "Double High Plan" group. The school conducts regular rectification and follow-up visits based on the situation of school enterprise cooperation, forming a continuous improvement cycle and continuously improving the quality level of school enterprise cooperation.

7. Conclusions

According to the completion of school enterprise cooperation, appropriate rewards or punishments will be given to the responsible person. For those responsible for completing school enterprise cooperation tasks that are relatively good, increase publicity and promotion, and provide rewards; Those responsible for inadequate implementation of rectification measures should be punished. Clarification of the reward and punishment system can mobilize the enthusiasm of second and third level leaders, and unresolved issues in the quality management process of school enterprise cooperation can be incorporated into the next cycle to further improve and enhance the quality management level of school enterprise cooperation

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