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Innovative Path and Incentive Mechanism of Enterprise Practice System for College Teachers in the Context of Industry-Teaching Integration

Linglanxuan Kong¹ and Dongtao Han^{2,*}

¹ Personnel Department, Shanghai Customs University, Shanghai, 201204, China

² School of Government, Shanghai University of Political Science and Law, Shanghai, 201701, China

Corresponding authors: (e-mail: handt123@126.com).

Abstract With the gradual implementation of the policy of integration of industry and education, the enterprise practice system for college teachers has become an important means to improve teachers' comprehensive ability. Effective teachers' enterprise practice system can promote teachers' in-depth cooperation with enterprises and enhance their vocational skills and knowledge system. This paper studies the innovation path and incentive mechanism of enterprise practice system for college teachers in the context of industry-teaching integration. The study adopted the experimental method, literature method, interview method and mathematical statistics method, and selected 100 teachers from a university in Province D to conduct the experiment, which was divided into the experimental group and the control group, and the experimental period was 12 weeks. Teachers in the experimental group adopted the innovative enterprise practice system and incentive mechanism, while teachers in the control group continued to adopt the conventional way of self-study and practice. The results show that the theoretical knowledge ability and professional skills of the teachers in the experimental group have been significantly improved. In terms of theoretical knowledge, the mean score of teachers in the experimental group increased from 2.472 to 3.977, an improvement of 1.505, and the difference was significant ($P=0.005$). In terms of professional skills, the teaching ability, teacher-student interaction and comprehensive scores of the experimental group also increased significantly, in which the teaching ability score increased from 2.411 to 3.992, and the teacher-student interaction score increased from 2.314 to 4.048, and the differences were all statistically significant ($P<0.05$). The conclusion shows that the innovative path and incentive mechanism of teachers' enterprise practice system in the context of industry-teaching integration can effectively improve teachers' theoretical knowledge ability and professional skills.

Index Terms Industry-teaching integration, teachers' enterprise practice, incentive mechanism, innovative path, theoretical knowledge ability, professional skills

I. Introduction

The integration of industry and education in colleges and universities refers to the establishment of a close-knit cooperation model between colleges and universities and industry enterprises and institutions to achieve the goal of mutual benefit and win-win situation by jointly carrying out education and training, scientific research and innovation, and exchange of talents and other activities [1]-[3]. This model aims to break down the barriers between traditional colleges and enterprises, promote the integration of industry and learning, enhance the employability of students, and promote the development of the industry [4]. In this context, a reasonable and innovative enterprise practice system and incentive mechanism for college teachers can help to form a sustainable ecology of school-enterprise synergistic development [5], [6].

College teachers' in-depth enterprise practice occupies a pivotal position in the teacher training system of college education, and professional teachers are required to go to the enterprise or the production and service line to practice at a specified time [7], [8]. This is not only to strengthen the teacher's own professional ability, to achieve the development of highly skilled personnel training goals, but also to realize the "dual-teacher" teacher transformation, improve the practical skills of teachers, which is conducive to the combination of education theory and practice of important initiatives [9]-[11]. At present, however, as China's economy enters a new normal, various institutions and departments are facing many difficulties from various sources, which invariably brings considerable pressure on university teachers to enter the enterprise for practice, and solving the problems encountered in the process of teachers' enterprise practice requires the joint attention and efforts of various parties [12]-[15].

The most important strategy for colleges and universities to gain an advantage in the competition lies in the development of effective incentive mechanisms, incentive is the process of achieving organizational goals through

certain measures to meet the needs of the teachers, thereby enhancing the intrinsic motivation of their behavior [16]-[18]. Motivation of university teachers involves the needs, motives, emotions, desires, pressures and other factors that act on university teachers and make them make behavioral choices - either to try hard or to slack off [19]-[21]. Good incentives can help to increase teachers' participation in business practices, thus enhancing the sustainability of industry-teaching integration [22].

The goal of this study is to explore how to effectively improve teachers' practical ability and comprehensive quality by exploring the innovative path and incentive mechanism of teachers' enterprise practice in the context of industry-education integration. Firstly, we analyze the current research results of teachers' enterprise practice through literature review, find the existing problems and shortcomings, and put forward corresponding innovative paths in combination with the actual situation. Secondly, in terms of research methodology, experimental method, interview method and mathematical statistics are used to ensure the reliability of the data and the scientificity of the research conclusions. The study implements different modes of teachers' enterprise practice by setting up experimental and control groups to assess the actual effects of different practice paths and incentive mechanisms. Finally, based on the results of data analysis, a set of innovative paths and incentive mechanisms of teachers' enterprise practice system suitable for application in colleges and universities is summarized to provide theoretical basis and practical guidance for the development of higher education.

II. Innovative Path and Incentive Mechanism of Teachers' Enterprise Practice System

II. A. Innovative Path of Teachers' Enterprise Practice System

II. A. 1) Establishment of standards for applied teachers

Teachers' enterprise practice is the way, and building an applied teacher team is the goal. Only by clarifying the direction of teachers' professional development and unifying the standards for applied teachers can teachers be better guided to practice in enterprises. Colleges and universities should combine the development experience of local transition colleges and universities to develop their own application-oriented teacher standards. Formulate the goal of teachers' enterprise practice. The goal of teachers' enterprise practice cannot stay on the shallow level of understanding enterprise practice, but must be constructed into teachers' knowledge system through teachers' active reflection and internalization under the guidance of professional teachers. The goal of teachers' enterprise practice should include three aspects: to improve teachers' practical teaching ability, applied research ability and market innovation ability, focusing on improving teachers' practical teaching ability.

II. A. 2) Standardize the assessment system

(1) Standardization of teachers' practical ability assessment

The standardization of assessment indexes, the specific goal of teachers' practice in enterprises is to improve teachers' practical teaching ability, applied research ability and market innovation ability. The diversity of human needs determines the diversity of incentives, which includes not only material incentives but also spiritual incentives. Applied colleges and universities should, on the one hand, clarify the evaluation mechanism, supervision mechanism and management mechanism of teachers' practical exercise, and do a good job of enterprise contact. On the other hand, establish and improve the scientific democratic management system, so that teachers can fully participate in the management of the school.

(2) Standardize the assessment of teachers' team in secondary schools

Schools pay attention to whether or not not only reflected in whether the introduction of documents, but the synchronization of supporting policies to follow up, there is no relevant assessment requirements, will make the colleges to produce a good do bad a feeling. Colleges and universities can increase the assessment of teacher training in the future assessment of secondary colleges, and at the same time, refine the assessment indicators, quantitative scoring of the indicators. In the usual supervision process, the supervision of the second-level colleges can be strengthened by means of refining the anonymous assessment of the network, strengthening the assessment of post-training effectiveness, and timely publication of inspection results.

II. A. 3) Increased teacher training

To address the problem of a single source of teachers, the requirement for teachers to practice in enterprises can be added to the induction training of new teachers, and some provinces have already made active exploration. For example, the Implementation Measures for the Training of Young Teacher Assistants (for Trial Implementation) formulated by University A in 2019 provides for the full implementation of the system of young teacher assistants, requiring that newly hired teachers with <3 years of teaching experience and age ≤ 35 years old not teach independently in the first year, and that teachers teaching courses with strong practicality must go to the enterprise to take off work for more than 3 months.



II. A. 4) Improving mechanisms for teacher practice

Teachers' enterprise practice includes practical exploration stage, theory internalization stage and theory reconstruction stage. In the practical exploration stage, teachers familiarize themselves with the positions and processes, and enterprise products. In the stage of ability internalization, teachers combine practical experience with curriculum teaching and applied research, and rise to the theoretical level by deconstructing and reconstructing the practical experience. The theoretical reconstruction stage includes both curriculum reconstruction and applied research. In the stage of curriculum reconstruction, teachers need to transform practical experience into curriculum knowledge under the guidance of curriculum experts, and in addition, through actively declaring applied research projects, they can timely raise practical understanding to the theoretical level and promote their experience.

II. B. Incentive mechanism of teachers' enterprise practice system

II. B. 1) Combining incentives and disincentives

In the use of reinforcement, positive reinforcement is more effective than negative reinforcement, but it does not mean that negative reinforcement is not used; rather, positive reinforcement is the mainstay, with punishment for bad behavior when necessary. Positive reinforcement is a way of guiding teachers to actively participate in enterprise practice by granting subsidies, rewards, and vacations. Negative reinforcement is a form of ex-ante avoidance that punishes behaviors that do not meet organizational goals. For example, in the evaluation of teachers' titles, going to enterprises for practice is regarded as a mandatory condition, otherwise they are not allowed to declare higher titles. In the evaluation of prizes and merits, teachers' practice in enterprises is regarded as a necessary condition for candidates. In terms of positive reinforcement measures, the experience of College B is worth learning from. The school divides an academic year into four semesters. Teachers can use the first semester of the half-year to complete their professional course tasks, and then go to enterprises for practice in the second semester, and the school will convert the number of days that teachers go to enterprises for practice into hours, and then calculate the hourly allowance uniformly at the end. In terms of negative reinforcement measures, many colleges and universities have made teachers' practice in enterprises a necessary condition for title evaluation. There are also some institutions that force teachers to create the need to go to enterprises for practice by means of skill competitions or skill examinations.

II. B. 2) Harmonization of material and moral incentives

Health care and motivation are the two main elements affecting work motivation, with health care factors being the basis and prerequisite and motivation factors being an important means of enhancing efficiency, and the two must be used in combination. Health-care factors mainly include working conditions and so on, which are related to material factors, while motivational factors are related to the sense of achievement, growth opportunities and the sense of being respected, which belong to the spiritual level of motivation. Therefore, material and spiritual incentives have to be combined. The professional improvement and sense of personal career achievement gained through practice inspire teachers to go to enterprises for practice. In terms of institutionalization and regularization, some colleges and universities take the initiative to get in touch with enterprises and establish practice bases for teachers. There are also some teachers of specialized courses, who have improved their hands-on ability by going to enterprises for practice, and have gained excellent results in skill competitions and guiding students to participate in skill competitions. Time and again, the sense of achievement in their careers has inspired teachers not to be satisfied with the status quo and to keep returning to enterprises to learn new techniques and technologies.

II. B. 3) Realization of collaborative management of enterprises and schools

At the government level, preferential policies should be introduced to support enterprises' participation in teachers' enterprise practice. First, tax incentives, teachers enterprise practice into the school-enterprise cooperation, in accordance with the preferential policies for enterprises participating in school-enterprise cooperation to implement the corresponding tax reduction measures. Second, the government to buy teachers practice positions, the local government can select a number of enterprises in the enterprise as a shared open teachers enterprise practice base, according to the teacher practice situation to the enterprise to allocate funds. The third is to recognize and reward enterprises and individuals with outstanding achievements in enterprise practice, and to expand the publicity and scope. At the university level, school-enterprise cooperation is the basis for teachers to practice in enterprises. Colleges and universities should pay attention to and meet the interests of enterprises in school-enterprise cooperation. According to the survey, the interests of enterprises in school-enterprise cooperation are, in order of priority, selecting satisfactory employees from school graduates, obtaining technical support from colleges and universities, and obtaining on-the-job training opportunities for enterprise employees. Teachers practicing in enterprises is one of the interests of vocational colleges in school-enterprise cooperation. According to the "equity theory", only if the interests of enterprises are satisfied, enterprises will welcome teachers to practice in enterprises.

In addition, on the basis of school-enterprise cooperation, vocational colleges and universities can adopt the “one teacher, one enterprise” model of teacher practice.

III. Research program design

III. A. Research questions and hypotheses

III. A. 1) Research questions

According to the research topic and content of this paper, the problem of this research can be clarified and it consists of two main research questions. Specifically described as follows:

- (1) Does the innovative path and incentive mechanism of teachers' enterprise practice system proposed in this paper enhance teachers' theoretical knowledge proficiency?
- (2) Does the innovative path and incentive mechanism of teachers' enterprise practice system proposed in this paper enhance teachers' professional skill proficiency?

III. A. 2) Research hypotheses

Based on the two research questions described in the previous section, two research hypotheses can be formulated. The detailed theoretical description is shown below:

- (1) The innovative path and incentive mechanism of teachers' enterprise practice system proposed in this paper can enhance teachers' theoretical knowledge proficiency.
- (2) The innovative path and incentive mechanism of teachers' enterprise practice system proposed in this paper can enhance teachers' professional skill proficiency.

III. B. Subjects of the study

100 general teachers from key undergraduate colleges in Province D were selected as experimental subjects. They are randomly divided into 2 groups, the first group of 50 people, the experimental group adopts the innovative path and incentive mechanism of teachers' enterprise practice system. The second group of 50 people, the control group adopts teachers' own learning and practice. The experimental group and the control group are taken as the independent variables of this study, while the dependent variables are set as theoretical knowledge ability and professional skill proficiency.

III. C. Research methodology

III. C. 1) Literature

This study uses the literature method, mainly using CNKI, Web of Science, Wanfang and other databases to conduct literature search with the themes of "integration of industry and education", "innovation path of enterprise practice system of college teachers", and "incentive mechanism of enterprise practice system of college teachers". The retrieved relevant data were summarized and summarized from the aspects of concept, current situation, research enlightenment, etc., and appropriate and valuable data were selected to complete the literature review, which provided theoretical support for the follow-up research.

III. C. 2) Experimental methods

According to the teacher training program of this D-school, every weekday at noon is the time for the teaching and research activities of colleges and universities to enhance teachers' professional development competence (knowledge competence, professional skills proficiency, and affective values), so this experiment chooses two different ways (innovative paths and incentives for teachers' enterprise practice system, and self-study and practice) to carry out the experimental interventions, and the experimental cycle of the two groups of teachers is 12 weeks, with a total of 12 classroom hours. In order to obtain the data needed for the study of this paper, combined with relevant References, the preliminary design of the Questionnaire on Enhancing Teachers' Career Development Ability in Colleges and Universities was developed, in which the scale used in the questionnaire was the Likert five-point scale. Through the way of pre-survey, it was found that the preliminary draft of the Questionnaire for Enhancing Teachers' Career Development Ability in Colleges and Universities still has a small part of problems, for this reason, experts in the relevant fields were asked to further improve the Questionnaire for Enhancing Teachers' Career Development Ability in Colleges and Universities, and it can be seen through the analysis of the reliability test that the questionnaire has an excellent performance of the reliability and validity, which ensures that the experimental data are in line with the actual situation.

III. C. 3) Interview method

This study adopted a combination of formal and informal interviews to capture and complement the research effectiveness of the action research. Formal interviews were conducted in a semi-structured way with the teachers

participating in the study using an interview outline prepared by the researcher in advance. On the one hand, it can better understand the problems of this research, and on the other hand, it can make up for the insufficiency of the scale research by combining the qualitative and quantitative approaches to make the research more convincing.

III. C. 4) Mathematical statistics

The research data obtained through the questionnaire scale test was imported into SPSS22.0 software, and the independent sample t-test method and paired sample t-test were utilized to confirm the two research hypotheses put forward above, which in turn reflected the innovative path of the enterprise practice system for college teachers and the actual utility of the incentive mechanism.

IV. Research program validation analysis

IV. A. Comparative analysis of teachers' theoretical knowledge competence

IV. A. 1) Before the experimental intervention

Before the start of the teaching experiment, the theoretical knowledge competence of the teachers in the control group and the experimental group after the test was counted and organized, and imported into the SPSS software for the analysis of differences, and the results of the comparative analysis before the experimental intervention are shown in Table 1. The data show that before the teaching experiment, the difference between the two groups of teachers in the basic theoretical knowledge ability is not significant ($P = 0.817 > 0.05$), the experimental group and the control group of teachers' theoretical knowledge ability level is in the same starting line, in line with the prerequisite for the conduct of teaching experiments.

Table 1: Comparative analysis before experimental intervention

Measurement index	N	Experimental group		Control group		P-Value	T-Value
		Mean	SD	Mean	SD		
Theoretical knowledge	50	2.472	0.341	2.431	0.332	0.817	-4.13

IV. A. 2) Comparative analysis of the experimental group before and after the intervention

After 12 weeks of experimental intervention, the theoretical knowledge competence of the teachers in the experimental group was tested and the results before and after the experiment were imported into the SPSS software for the analysis of variance, and the comparative analysis of the experimental group before and after the pre- and post-experiment is shown in Table 2. The table shows that after the 12-week experimental intervention, the pre-experimental theoretical knowledge competence of teachers in the experimental group increased by 1.505, and the difference is very significant ($P=0.005<0.05$). Therefore, the innovative path and incentive mechanism of teachers' enterprise practice system can significantly improve the level of teachers' theoretical knowledge competence.

Table 2: Comparative analysis of the EG before and after the intervention

Measurement index	N	Before		After		P-Value	T-Value
		Mean	SD	Mean	SD		
Theoretical knowledge	50	2.472	0.341	3.977	0.524	0.005	1.27

IV. A. 3) Comparative analysis of the control group before and after the intervention

Using the same methodology as described above, with the help of SPSS 22.0 software, the differences in the theoretical knowledge competence of the teachers in the control group before and after the intervention were explored, and the results of the comparative analysis of the control group before and after the intervention are shown in Table 3. The data shows that after the experimental intervention through 12 weeks, the theoretical knowledge competence of the teachers in the control group increased by 0.402 compared to the pre-experimental period, and there is no significant difference ($P=0.069>0.05$). Therefore, the effect of adopting conventional methods on the improvement of teachers' theoretical knowledge competence was not significant.

Table 3: Comparative analysis of the control group before and after the intervention

Measurement index	N	Before		After		P-Value	T-Value
		Mean	SD	Mean	SD		
Theoretical knowledge	50	2.431	0.332	2.833	0.447	0.069	-1.08

IV. A. 4) Post experimental intervention

In order to objectively compare the effect of the method of this paper and the conventional method in improving the level of theoretical knowledge of students' teachers, the level of theoretical knowledge of teachers of the experimental group and the control group of students after the teaching experiment was imported into SPSS software 22.0, and an independent samples T-test was conducted, and the results of the comparative analysis after the experimental intervention are shown in Table 4. The data show that after the 12-week experimental intervention, the basic theoretical knowledge competence of teachers in the experimental group is 1.144 points higher than that of the control group, and the difference is very significant ($P=0.017<0.05$), which confirms the research hypothesis proposed above (the innovative paths and incentive mechanisms of the teachers' enterprise practice system proposed in this paper are able to enhance the theoretical knowledge competence of teachers).

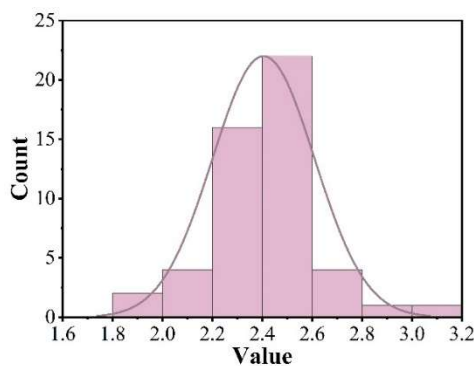
Table 4: The results were compared and analyzed after the experimental intervention

Measurement index	N	Experimental group		Control group		P-Value	T-Value
		Mean	SD	Mean	SD		
Theoretical knowledge	50	3.977	0.524	2.833	0.447	0.017	3.421

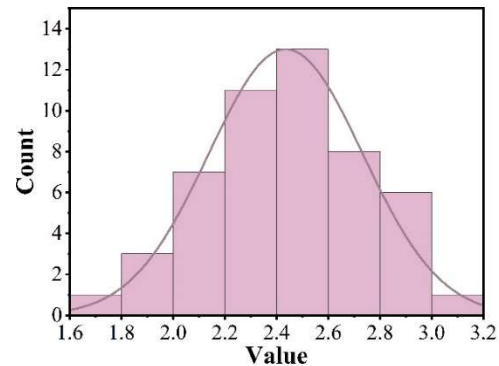
IV. B. Comparative analysis of teachers' professional skills

IV. B. 1) Analysis of the pre-test of teachers' professional skills

In order to present the data more graphically and intuitively, the scores of each dimension of the pre-test of teachers' professional skills (personal competence, teaching methods, and teacher-student interaction) were plotted as a frequency distribution histogram as shown in Figures 1-4, with the experimental group on the left and the control group on the right. The horizontal coordinates of the graph represent the scores of each dimension, and the vertical coordinates are the frequencies. From the histogram distribution, it can be found that the distribution of values of teachers' professional skills is basically similar between the experimental group and the control group.

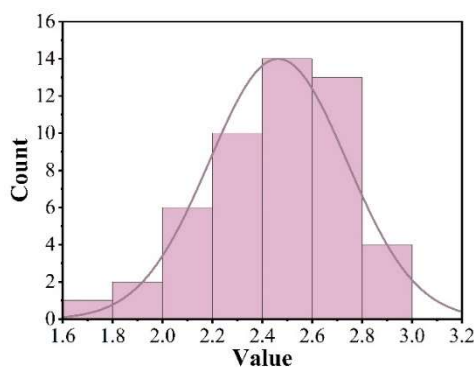


(a)Experimental group

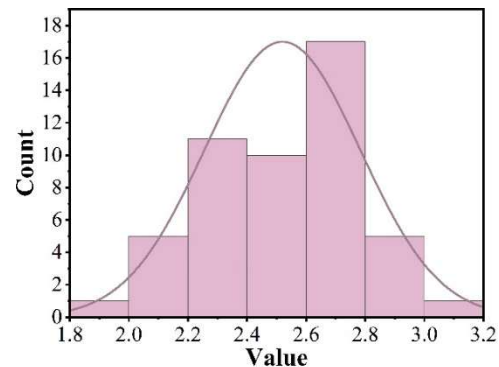


(b)Control group

Figure 1: Distribution of pre-test scores in the dimension of personal ability



(a)Experimental group



(b)Control group

Figure 2: The distribution of pre-test scores in the dimension of teaching methods

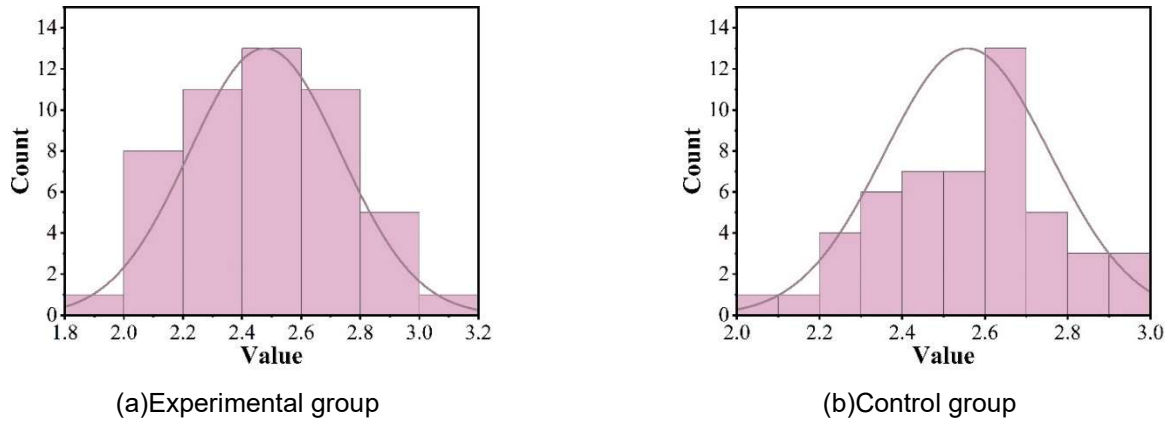


Figure 3: Pre-test of the dimension of teacher-student interaction

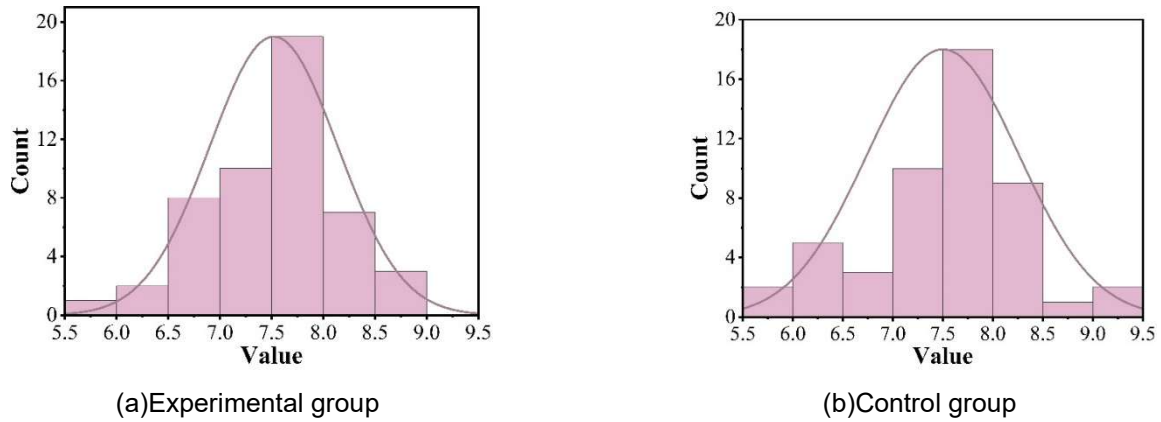


Figure 4: The distribution of pre-test scores in the total score

IV. B. 2) Post-test analysis of teachers' professional skills

In order to present the data in a more visual and intuitive way, the values of each dimension of the pre-test of teaching skills were plotted as a histogram of the frequency distribution as shown in Figure 5-Figure 8. The horizontal coordinate of the graph represents the numerical situation of each dimension, and the vertical coordinate is the frequency. Synthesizing the data performance in the graph, it can be found that the difference between the professional skills of teachers in the control group and the experimental group after the intervention is more obvious.

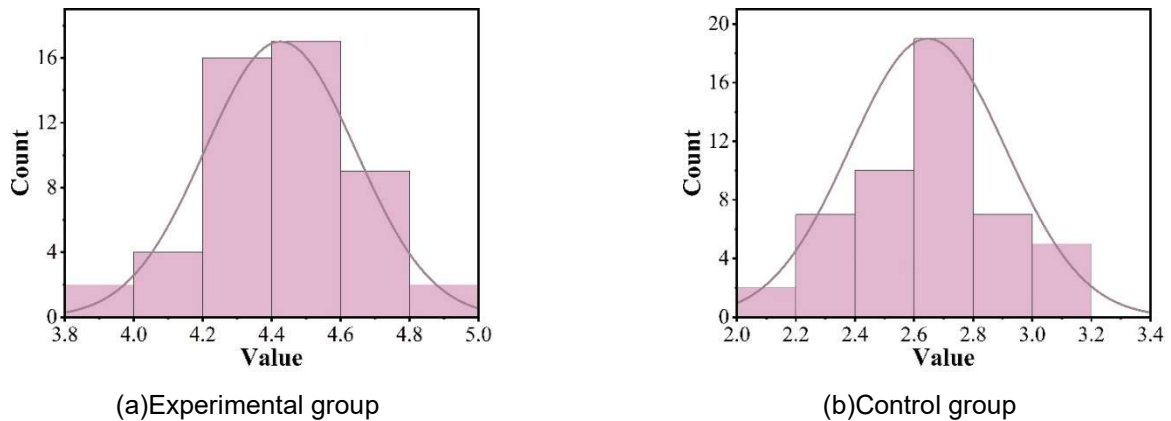


Figure 5: Post-test of personal ability dimension

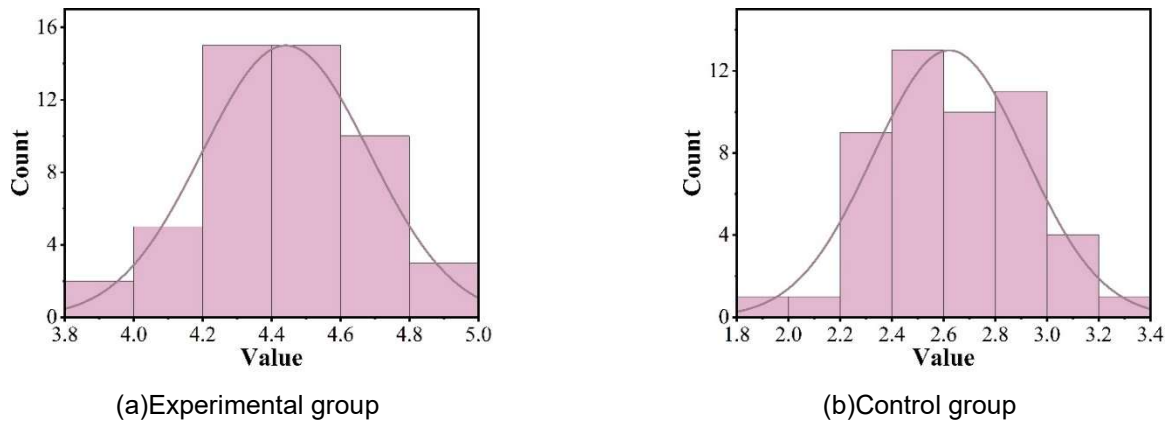


Figure 6: Post-test of the teaching method dimension

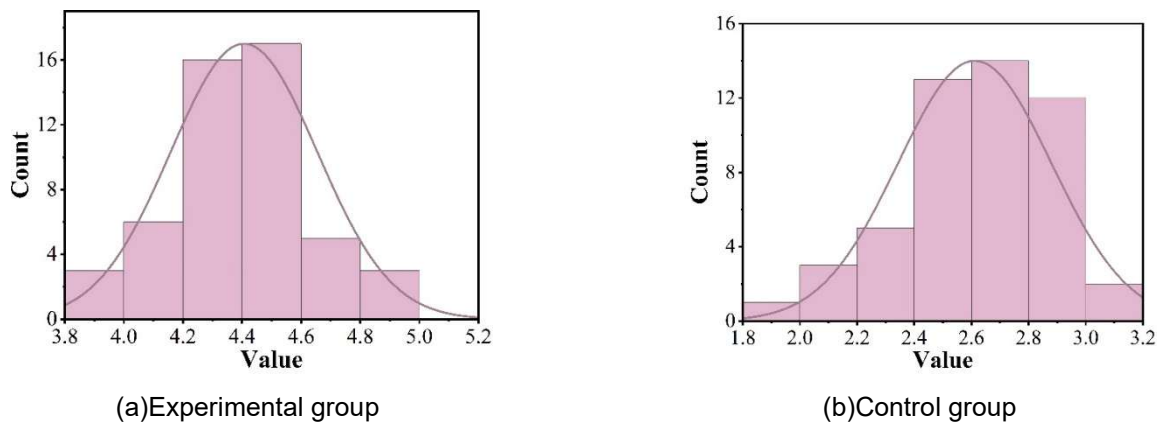


Figure 7: Post-test of the dimension of teacher-student interaction

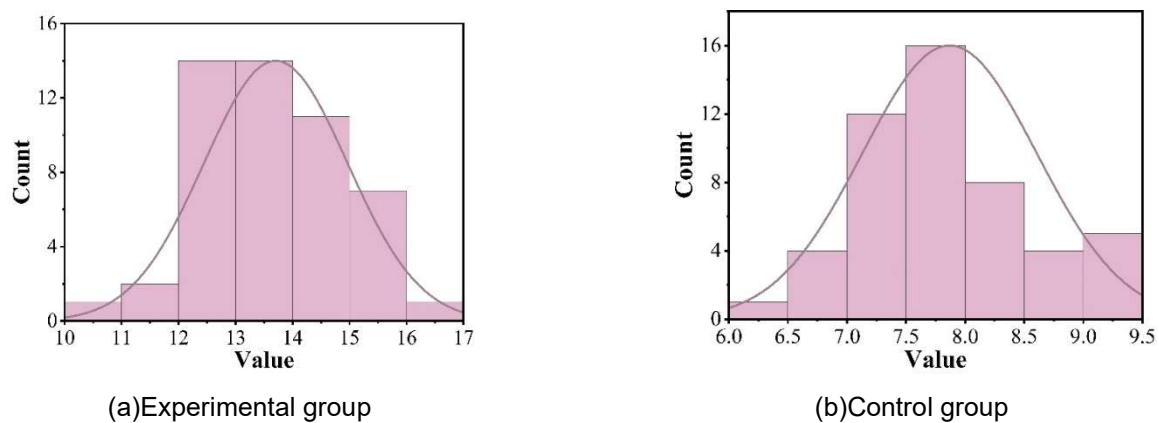


Figure 8: Post-test of the total score

IV. B. 3) Independent samples t-test

In order to more accurately test whether there is a difference in the pre-test scores of teachers' professional skills between the two groups, the study conducted an independent samples t-test using SPSS, and the results are shown in Table 5. Personal competence dimension $t=0.846$, $p=0.338>0.05$, teaching methodology dimension $t=0.137$, $p=0.831>0.05$, teacher-student interaction dimension $t=0.807$, $p=0.408>0.05$, and the total score $t=0.649$, $p=0.445>0.05$. The results of the data analysis showed that the teachers of the experimental group and the control group had a difference between their teachers' scores on the personal competence, teaching methodology, and teacher-student interaction dimensions, as well as the difference in the total score of teaching skills were not at a statistically significant level. This indicates that there is no significant difference between the two groups of subjects in terms of their basic level before the intervention.

Table 5: Independent sample t-test

Dimension	Group	N	M	SD	T-Value	P-Value
Personal ability	Experimental group	50	2.411	0.237	0.846	0.338
	Control group	50	2.367	0.224		
Personal ability	Experimental group	50	2.376	0.214	0.137	0.831
	Control group	50	2.399	0.25		
Teacher-student interaction	Experimental group	50	2.314	0.268	0.807	0.408
	Control group	50	2.385	0.257		
Total score	Experimental group	50	0.701	0.719	0.649	0.445
	Control group	50	0.715	0.731		

IV. B. 4) Paired samples t-test

In order to test whether the method of this paper and the traditional method improved teachers' professional skills, the study used SPSS to analyze the data, and conducted paired-sample t-tests on the scores of the pre and post-tests of professional skills of the two groups of subjects respectively. In SPSS, click on "Data - Select Case", set to "Output if condition meets group=1", and select the experimental group data. Continue to click "Analyze - Compare Means - Paired Samples T-Test" to set the paired variables. The results of data analysis are shown in Tables 6 to 7. The results of the data analysis of the experimental group showed that the pre and post-test scores of teachers' professional skills improved in all dimensions and reached the level of significance ($p < 0.05$), while the control group did not reach the level of significance, and the results of the paired samples t-test confirmed the research hypothesis proposed above (the innovative path and incentive mechanism of the teachers' enterprise practice system proposed in this paper can improve the proficiency of teachers' professional skills).

Table 6: The paired sample t-test was conducted in the experimental group

Dimension	Group	N	M	SD	T-Value	P-Value
Personal ability	Before	50	2.411	0.237	5.296	0.008
	After	50	3.992	0.465		
Personal ability	Before	50	2.376	0.214	4.154	0.001
	After	50	3.968	0.509		
Teacher-student interaction	Before	50	2.314	0.268	4.432	0.004
	After	50	4.048	0.556		
Total score	Before	50	7.109	0.719	4.314	0.005
	After	50	12.008	1.538		

Table 7: T-test for paired samples in the control group

Dimension	Group	N	M	SD	T-Value	P-Value
Personal ability	Before	50	2.367	0.224	2.477	0.128
	After	50	2.782	0.376		
Personal ability	Before	50	2.399	0.25	4.251	1.031
	After	50	2.713	0.411		
Teacher-student interaction	Before	50	2.385	0.257	1.231	0.122
	After	50	2.747	0.321		
Total score	Before	50	0.715	0.731	2.207	0.072
	After	50	8.242	1.108		

V. Conclusion

The innovative path and incentive mechanism of teachers' enterprise practice system in the context of industry-education integration has a significant effect on improving teachers' theoretical knowledge ability and professional skills. Through the comparative analysis of the data of the experimental group and the control group, the teachers of the experimental group significantly outperformed the control group in the improvement of theoretical knowledge and professional skills. In terms of theoretical knowledge ability, the average score of teachers in the experimental group increased from 2.472 to 3.977, an increase of 1.505, with a significant difference ($P = 0.005$), which proves the effectiveness of the teachers' enterprise practice system in improving teachers' theoretical level. In terms of professional skills, the scores of teachers in the experimental group in the dimensions of personal competence,

teaching methods, and teacher-student interactions all increased significantly, with personal competence increasing from 2.411 to 3.992, teaching methods from 2.376 to 3.968, and teacher-student interactions from 2.314 to 4.048, and the overall score increasing from 7.109 to 12.008, with all the indexes being statistically significant ($P < 0.05$). These results show that through the scientific incentive mechanism and the innovative design of the practice system, it can effectively promote the development of teachers' professional competence and enhance their application ability in teaching.

The innovative path and incentive mechanism of teachers' enterprise practice system play a positive role in improving teachers' teaching quality and professional ability, and through reasonable incentives, it can stimulate the enthusiasm of teachers' participation, thus promoting the overall improvement of the quality of university education.

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