

Work-Study Combination Mode on the Learning Quality of Practical Courses in Higher Vocational Colleges in Jiangsu Province.China

Li Zhanfeng and Roselan Baki

Abstract – This study focuses on the impact of the integrated middle class teaching model on the learning quality of practical courses in Jiangsu vocational colleges. With the increasing demand of the society for skilled talents, the innovation of teaching mode and the quality of practical courses in higher vocational colleges, as an important base for training high-quality skilled talents, are particularly important. In this context, the purpose of this study is to explore how the model of integration of production and education affects the learning quality of practical courses by improving students' learning ability. The research adopts quantitative research method, through the construction of a theoretical model with the industry-university-research model as the independent variable, learning ability as the intermediary variable, and the quality of practical courses as the dependent variable, in-depth analysis of the relationship between the three. The study design includes random sampling and the distribution of paper questionnaires to ensure the universality and reliability of the data. At the same time, descriptive statistics, correlation analysis, regression analysis and variance analysis are used to analyze the data in detail. It is found that the model of production-education integration has been effectively implemented in Jiangsu higher vocational colleges, which not only promotes the deep cooperation between schools and enterprises, but also provides more practical opportunities for students.

Keywords – Integration Model of Production and Education; Higher Vocational Colleges in Jiangsu Province; Practical Courses; Learning Quality; Influencing Factor

I. INTRODUCTION

This chapter mainly describes the research background, research problem statement and research gaps, as well as the establishment of the research content and objectives, the definition of the research conceptual framework and the explanation of the research concept, and the statement of the research content and significance.

Background of the Research

(1) The Gradual Development of Industry-teaching Integration in Chinese higher Vocational Education

The integration of entrepreneurship and education is

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one of the major trends in the field of education today, and this trend has gained much attention and importance globally.

In China, with the continuous development of economy and upgrading of industrial structure, the national policy of school-enterprise cooperation and integration of industry and education has been gradually deepened and promoted (Li, 2024).

(2) Higher Vocational Colleges and Universities Offer Practical Courses Based on the Integration of Industry and Education

(3) Jiangsu Province has Advantages in the Implementation of Industry-teaching Integration

Jiangsu Province has obvious advantages in the implementation of industry-education integration, and these advantages not only promote the deep integration of education and industry, but also make important contributions to the economic development and social progress of Jiangsu Province and the whole country.

Problem Statements

The integration mode of industry and education has shown positive effects in the practical courses of higher vocational colleges and universities in Jiangsu Province, but there are also problems that need to be further solved.

Research Gap

The industry-teaching integration model represents an educational approach that seeks to integrate academic and professional training in a manner that enhances students' vocational abilities and employability (Guangdong Light Industry Vocational and Technical College, 2022). However, despite its potential, the practical implementation of this model in higher vocational colleges and universities in Jiangsu Province still faces several challenges and gaps (Xu and Feng, 2022). These are primarily evident in:

Insufficient alignment between the curriculum and the needs of enterprises: Insufficient practical teaching resources: and Inadequate evaluation system:

Research Objectives

This study is committed to firstly clarifying the implementation status of practice courses in Jiangsu Province's higher vocational colleges and universities, the main objectives of this study are as follows:

RO1: To study the impact of university-industry collaboration model on the learning quality of practical

courses in Jiangsu Province higher vocational colleges and universities.

RO2: To study the impact of industry-university-research partnership model on the learning quality of practical courses in Jiangsu Province higher vocational colleges and universities.

RO3: To study the impact of regional collaborative development mode on the learning quality of practical courses in Jiangsu Province higher vocational colleges and universities.

RO4: To study whether learning ability plays a mediating role in the impact of industry-teaching integration model on the learning quality of practical courses in Jiangsu higher vocational colleges.

Research Questions

This research aims to provide strong theoretical support and practical guidance for the reform and development of practice courses in higher vocational colleges and universities in Jiangsu Province. Therefore, this study proposes the following research questions:

RQ1: What is the impact of the university-industry collaboration model on the learning quality of practical courses in Jiangsu higher vocational colleges and universities?

RQ2: What is the impact of industry-university-research partnership model on the learning quality of practical courses in Jiangsu higher vocational colleges and universities?

RQ3: What is the impact of regional collaborative development model on the learning quality of practical courses in Jiangsu higher vocational colleges and universities?

RQ4: What is the mediating role of learning ability in the impact of industry-teaching integration model on the learning quality of practical courses in Jiangsu higher vocational colleges and universities?

Research Hypothesis

The specific hypotheses are as follows:

H1: The university-industry collaboration model has a positive impact on the learning quality of practical courses in higher vocational colleges in Jiangsu Province.

H2: The industry-university-research partnership model has a positive impact on the learning quality of practical courses in higher vocational colleges in Jiangsu Province.

H3: The regional collaborative development model has a positive impact on the learning quality of practical courses in higher vocational colleges in Jiangsu Province.

H4: Learning ability plays a mediating role in the impact of industry-teaching integration on the learning quality of practical courses in higher vocational colleges in Jiangsu Province.

Scope of the Study

This research also pays special attention to the experiences and feelings of individuals in practical course learning, with a view to revealing the intrinsic connection between the integration of industry and education and the quality of practical course learning at the individual level.

- (1) What: The research will study the integration of production and education in higher vocational colleges and the quality of practical courses in higher vocational colleges since 2018.
- (2) Where: The scope of this study is vocational colleges in Jiangsu Province, China
- (3) Who: The scope of this study was for individuals attending practical courses from vocational colleges in Jiangsu Province, China

Significance of the Study

It is therefore of great practical importance and far-reaching significance to study the impact of the quality of practice courses in higher vocational colleges in Jiangsu Province.

Definition of Terms

Industry-teaching Integration Mode: it means that vocational schools actively open professional industries according to the specialities they set up, closely combine industry with teaching, mutually support and promote each other, and turn the schools into industrial business entities integrating personnel training, scientific research and scientific and technological services, forming a mode of schooling in which the school and the enterprise become one (Wang and Du, 2022).

Higher Vocational Colleges: mainly refers to university colleges and universities.

Practical Courses: These are integrated learning activities carried out by students under the guidance of teachers and on their own initiative (Wu, 2022).

Quality of Learning: It is an important indicator of students' learning effectiveness, which not only focuses on

the accumulation of knowledge, but also emphasises the depth of understanding and the ability of practical application (Dahalan et al., 2024).

Summary

This study adopts quantitative research method, with the model of industry and education as the independent variable, learning ability as the intermediary variable, and the quality of practice course as the dependent variable, and studies the relationship between the model of industry and education and the quality of practice course society.

II. LITERATURE REVIEW

This chapter deeply discusses the core theoretical basis of industrial education integration, which emphasizes the close combination of education and industry, aiming at meeting the needs of industrial development through educational reform and promoting the modernization of education. 2.2 Theoretical Framework

Synergy Theory

Synergy theory is a theory to study the interaction and cooperation between different systems, organizations or individuals.

(1) The Concept and Connotation of Synergy Theory

Synergy theory is a multidisciplinary theory, which emphasizes the cooperation and coordination between different systems, organizations or individuals in order to achieve common goals and optimize overall efficiency (Li, 2021). This theory is widely used in many fields such as public management, enterprise management, social science and so on. .

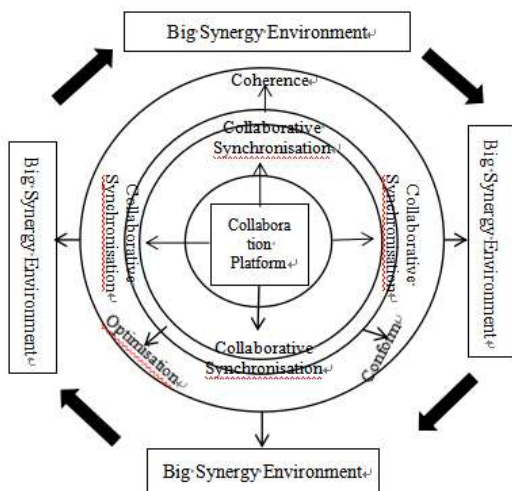


Figure 1. Conceptual Framework of Synergy Theory

In the field of public management, synergy theory emphasizes the interaction and cooperation among government, market and society (Li & Wei, 2021).

(2) Triple Helix Theory

The triple helix theory describes the interactive relationship among university, industry and government, and emphasizes the role of their cooperation in promoting scientific and technological innovation and economic development, which provides a more specific theoretical framework and model for Industry-University-Research's cooperation (Cai & Etzkowitz, 2020).

The Concept and Connotation of Triple Helix Theory

Triple helix theory is an innovative conceptual model, which was put forward by Henry Etzkowitz and reuter Reddes in 1990s to describe and analyze the new interaction and synergy among universities, industry and government in the era of knowledge economy (Cai & Lattu, 2022).

The triple helix theory also emphasizes the importance of innovation culture, and encourages all social strata to take an open attitude and actively participate in innovation. With the deepening of globalization and knowledge economy, the triple helix theory will continue to provide theoretical guidance and practical reference for the formulation of innovation policies, the construction of innovation systems and the improvement of innovation capabilities (Zhou & Etzkowitz, 2021).

(3) Industrial Cluster Theory

Industrial cluster theory is an economic theory, which holds that in a specific geographical area, similar or related enterprises, suppliers, service providers and related institutions can gather together to form a strong competitive advantage (Zokirova et al., 2021).

(4) Theoretical Framework

Based on the above theories, the conceptual framework of this study is composed, as shown in the figure.

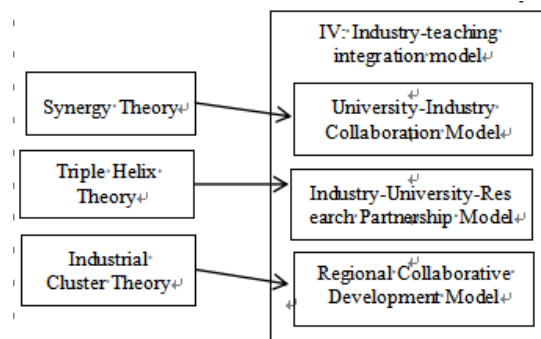


Figure 2. Theoretical Framework

Conceptual Framework

(1) Industry-teaching Integration Model

The mode of integration of production and education is a practice of educational reform, which aims to improve

the quality of education and meet the talent demand of industrial development through the deep integration of education and industry (Zuo and Deng, 2021).

Evaluation Dimension of University-Industry Collaboration Model

School-enterprise cooperation mode, as an educational mode of jointly cultivating talents by education and industry, has a multi-dimensional and comprehensive evaluation method, involving educational achievements, industrial demand satisfaction, student development and other aspects (Xu, 2023).

(2) Industry-University-Research Partnership Model

The cooperation mode in Industry-University-Research usually involves enterprises, universities and research institutions, which jointly carry out research and development activities by establishing joint laboratories, R&D centers or project cooperation (Cui & Li, 2022).

i. Overview of Industry-University-Research Partnership Model

Industry-University-Research cooperation model is a comprehensive model that closely combines industry, academia and research institutions to jointly promote knowledge innovation, technological development and personnel training (Bai et al., 2020).

ii. Measurement Dimension of Industry-University-Research Partnership Model.

As an important mechanism to promote scientific and technological innovation and personnel training, Industry-University-Research's cooperation model has many evaluation dimensions, including cooperation effect, cooperation process, cooperation subject and cooperation environment (Bai et al., 2020).

iii. Regional Collaborative Development Model

The concept of Regional Collaborative Development Model comes from the understanding of the imbalance of regional development, aiming at forming a joint force and promoting the all-round development of economy and society through cooperation among regions in the region (Fan et al., 2020). The goal of this model is to narrow the development gap, promote the balanced development of all regions in the region, realize the optimal allocation of resources in the region, and enhance the overall economic strength and social well-being of the region (Di et al., 2021).

iv. Quality of Learning in Practical Courses

The criteria for evaluating students' skill mastery in practice courses are multi-dimensional (Zhong & Kong, 2022). These standards usually include but are not limited to the following aspects:

Operational skills,

Problem-solving ability, Innovation and adaptability, The ability to combine theory with practice, Teamwork and communication skills, Self-learning and continuous improvement ability.

Learning Ability

The learning ability of students in higher vocational colleges mainly includes knowledge acquisition, understanding and application. The level of learning ability directly affects the learning effect and quality, and is one of the key factors of learning success.

v. Conceptual Framework

Summarizing the research experience of scholars, the final conceptual framework of this study is shown in Figure 3.

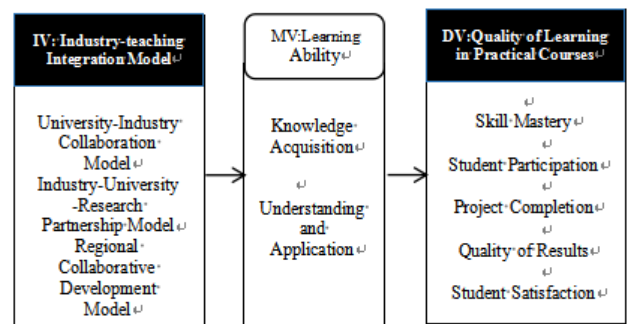


Figure 3 Conceptual Framework

Research Status of Integration of Production and Education Development Mode in Higher Vocational Colleges in Jiangsu Province

Jiangsu higher vocational colleges have made remarkable progress in the development mode of integration of production and education. Therefore, it is typical to take the students of higher vocational colleges in Jiangsu Province as samples to conduct this survey.

Summary

This chapter discusses the theoretical introduction, theoretical framework, teaching quality theory and theoretical introduction and model of the core theory of industry-education integration, and determines the theoretical support and framework needed for the research.

III. RESEARCH METHODOLOGY

In this study, the quantitative analysis method is used for specific analysis. This chapter mainly introduce the specific methods of this study, research design, population and samples, data collection tools, data collection process and data analysis methods, which paves the way for the next chapter.

Research Design

The research design represents the initial phase of a study. In this particular study, the research design was primarily established through the utilisation of questionnaires. The specific flow of the study is illustrated in Figure 4.

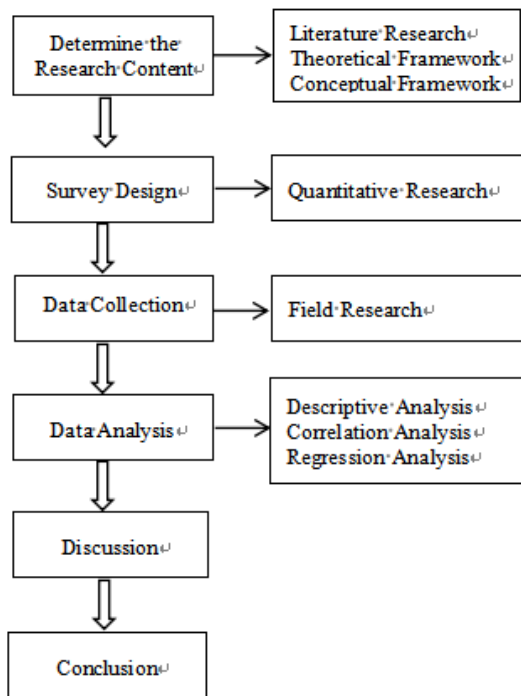


Figure 4. Study Design Process

As illustrated in the above figure, the initial step is to ascertain the content of the study prior to questionnaire design. The second step is to design the survey instrument, as this study is a quantitative study. The third stage of the study is the collection of data. The fourth step is to analyse the data. The fifth step is to conduct a discussion of the relevant results based on the data, with a particular focus on the specific impact of the industry-teaching integration model on the practical courses in higher vocational colleges. The sixth step is to present a conclusion, indicating the factors that influence the integration of industry and education in relation to the advancement of high-quality practical courses in higher vocational colleges. In particular, the study is designed on the following scale:

(1) Design of Industry-teaching Integration Model Scale

The evaluation dimension of industry-university-research's cooperation model needs to comprehensively consider the cooperation effect, cooperation process, cooperation subject, cooperation environment and

cooperation sustainability. The regional collaborative development model should include economic development coordination, environmental sustainability, environmental sustainability, collaborative efficiency and cultural identity (Wang & Du, 2022). Based on this, combined with the actual situation.

(2) Design of Learning Ability Scale

It can be seen from the above scholars' research that learning ability mainly includes knowledge acquisition, understanding and application, in which knowledge acquisition can be evaluated by cognitive efficiency and learning strategies, and understanding and application can be evaluated by problem-solving tasks, case studies, simulation experiments, project work and reflective practice (Wang, 2021). Therefore, this study designed a questionnaire for the Learning Ability Scale as follows:

(3) Design of Vocational College Quality of Learning in Practical Courses Scale

(4)

Skill mastery can be evaluated by operating skills, problem solving ability, innovation and adaptability, combination of theory and practice, teamwork and communication ability, and self-learning and continuous improvement ability; Student participation can be evaluated by students' attendance, classroom interaction frequency, the quality of homework and project completion, the enthusiasm of participating in extracurricular practical activities, and the interest and enthusiasm for course content; The degree of project completion can be evaluated by the degree of goal achievement and quality standards; The quality of results can be evaluated through innovation, practicality, completeness and professionalism; Student satisfaction can be evaluated through course content, teaching methods, learning resources and learning results.

It should be pointed out that the scales in this study are all designed by the five-point method, so in the process of designing questionnaire questions, they are all designed in the form of questions about the degree of agreement. According to the five-point method of Likert, "1~5" means "completely disagree", "relatively disagree", "neutral", "relatively agree" and "completely agree" respectively, and participants should choose according to their own situation.

Population and Samples

(1) Survey Population

These students' learning experience, skills mastery and views on the industry-teaching Integration Model will be an important basis for research and analysis. The specific population sample size is shown in Table 1 below:

TABLE I: DISTRIBUTION OF SAMPLE SCHOOLS AND STUDENTS IN SCHOOL

School	Number of students in school
Nanjing University	14714
Nanjing University of Aeronautics and Astronautics (NUAA)	19715
Nanjing University of Science and Technology	16472
Nanjing university of posts and telecommunications	17100
Nanjing Institute of Technology	24690
Jinling Institute of Technology	20000
sanjiang university	21316
xuzhou institute of technology	22500
amount to	156507

According to the relevant data of the National Bureau of Statistics and the provisions of the relevant university curriculum system of the Ministry of Education, students from eight higher vocational colleges, namely Nanjing University, Nanjing University of Aeronautics and Astronautics, Nanjing University of Science and Technology, Nanjing University of Posts and Telecommunications, Nanjing Institute of Engineering, Jinling Institute of Technology, sanjiang university and xuzhou institute of technology, are selected as the total population. As shown in Table 3.4, the total population of this study is 156,507.

(2) Survey Samples

Among the 156,507 people in the total population, this study adopts the method of random sampling, and finally selects 384 students as the sample of this study. The sample size required for this study can be obtained from the following sampling estimation formula (Yamane, 1967).

$$n = \frac{N}{1 + N(e)^2}$$

Among them:

N represents the sample size.

N represents the population being studied.

E stands for marginal error

Sample size with accuracy level of 5%, in which the confidence level is 95%, P= 0.5:

$$n = \frac{156507}{1 + 156507 \times (0.05)^2} = 384$$

In order to ensure the reliability of the questionnaire, this study selected 30 school teachers outside the sample to fill in the questionnaire and put forward corresponding questions. Three experts in this field gave suggestions on the reliability of the questionnaire after filling in the questionnaire. After screening, this study further verified the reliability of the questionnaire through reliability and validity analysis.

Pilot Tests

This experimental test primarily aims to examine both the reliability and validity of the questionnaire.

(1) Reliability Analysis

This study can understand the stability and reliability of measuring tools, thus ensuring the accuracy and effectiveness of the research results.

TABLE 2. RELIABILITY ANALYSIS OF QUESTIONNAIRE

Variable	Number of topics (n)	Cronbach's α Coefficient
Industry-teaching Integration Model	12	0.841
Learning quality of practical courses	21	0.912
learning ability	7	0.829

As illustrated in the table above, this research study focused on three core variables: the integration model of industry and education, the quality of learning in practical courses, and learning ability. Each of these variables comprises a different number of questions. The Cronbach's alpha coefficients for the aforementioned variables were 0.841, 0.912 and 0.829, respectively. These coefficients were all greater than 0.7 following specific analyses using SPSS, indicating a high degree of internal consistency and reliability in the measurement of the corresponding concepts.

(2) Validity Analysis

The results of the validity test for this study are presented in Table 3.

TABLE 3. KMO AND BARTLETT TESTS

KMO sampling suitability quantity		0.897
Bartlett Sphericity Test	Approximate chi-square Freedom Significance	1515.558
		243
		0.000

As demonstrated in Table 3.6, the KMO value of the questionnaire employed in this study is 0.897, which is greater than 0.7, and the significance of the Bartlett's test is 0.000. This value is less than 0.05, indicating that further factor analysis can be conducted. The results of this analysis indicate that the reliability of the questionnaire is good, and that the results can be used to carry out the follow-up of the specific study.

A summary of the results of the above experimental tests indicates that the reliability and validity of the

corresponding questionnaire of this study is high, and that it can be distributed and used to conduct subsequent studies.

Research Instruments

Through quantitative and qualitative research methods, this paper discusses the impact of the Industry-teaching Integration Model on the learning level of students' practical courses, and analyzes the intermediary role of learning ability in this process. The setting of research questions is based on the in-depth analysis of current educational practice, aiming at providing valuable insights and suggestions for educational policy makers and practitioners through empirical research. The specific list is shown in Table 4 below:

TABLE 4. LIST OF RESEARCH INSTRUMENTS

Question	Research tool	Source
What is the general situation of the samples participating in this survey?	Basic questionnaire	Xu & Sun, (2024)
What is the impact of the Industry-teaching Integration Model on the learning quality of practical courses in higher vocational colleges in Jiangsu Province?	Questionnaire on Industry-teaching Integration Model Questionnaire on Learning Quality of Practical Courses in Higher Vocational Colleges	Wang (2021)
Does learning ability play an intermediary role in the study of the impact of the Industry-teaching Integration Model on the learning quality of practical courses in higher vocational colleges in Jiangsu Province	Questionnaire on Industry-teaching Integration Model Questionnaire on Learning Quality of Practical Courses in Higher Vocational Colleges Questionnaire on learning ability	Miao (2021) Zuo & Deng, (2021).

Data Collection

Based on the specific requirements of this study, the finalised data collection process is illustrated in Figure 5.

In this study, random sampling was primarily used for the final sampling of 384 students from eight universities in Jiangsu Province. In order to ensure a balanced sample, 192 female and 192 male students were selected for the survey. In addition, 48 students from each higher education institution and 16 students from each grade were selected to participate in the research. The finalised sampling method was to conduct the research with 8 male and 8 female students from each grade in each higher vocational institution.

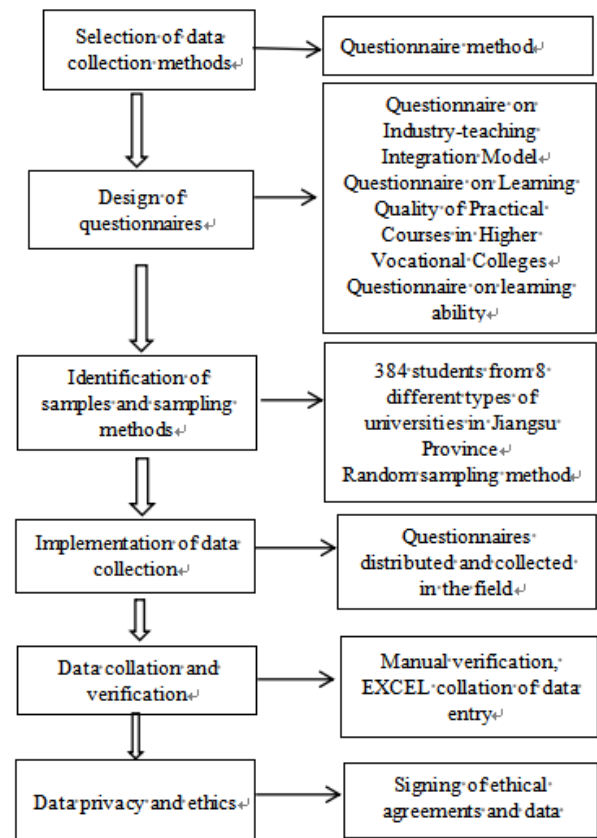


Figure 5. Data Collection Flowchart

Data Analysis

Summarize the data analysis method of this study, mainly including the following three points:

Descriptive analysis of samples: mainly analyze the basic situation of participants, including gender, age, grade, major, training time of accepting the industry-teaching Integration Model, etc., and conduct specific research by using percentage and mean analysis methods.

Correlation analysis: This paper mainly analyzes the impact of the industry-teaching Integration Model on the learning quality of practical courses in higher vocational colleges in Jiangsu Province, and uses SPSS software to analyze the corresponding five-point questionnaire. If there are relevant conditions in the end, it shows that the Industry-teaching Integration Model has an impact on the learning quality of practical courses in higher vocational colleges in Jiangsu Province.

Regression analysis: mainly by analyzing the size of regression coefficient, this paper analyzes the impact of the Industry-teaching Integration Model on the learning quality of practical courses in higher vocational colleges in Jiangsu Province. The larger the coefficient, the stronger the impact, and verifies whether learning ability plays an intermediary role in it.

Summary

This chapter comprehensively designs the impact of the integration mode of production and teaching on the learning quality of practical courses in higher vocational colleges in Jiangsu Province.

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