

Research on the Quality Evaluation System of Practical Teaching in Vocational Undergraduate Education based on Multiple Subjects

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Abstract: Practical teaching is the core link in talent training of vocational undergraduate education, and its quality directly affects the formation of students' professional competence and post competency. At present, vocational undergraduate colleges generally lack a systematic practical teaching quality evaluation system that fits their educational characteristics, making it difficult to meet the needs of teaching diagnosis and improvement as well as quality enhancement. Based on the CIPP model, situated learning theory and competency-based education concept, this paper constructs a quality evaluation system covering the entire process of practical teaching with the joint participation of multiple subjects. Using literature research, Delphi method expert consultation and AHP (Analytic Hierarchy Process), the study forms an evaluation framework including five first-level indicators, fifteen second-level indicators and several third-level observation points, and determines the weight of each indicator. The research results show that the practical teaching process (weight 0.372) and students' practical competence development (weight 0.284) are the key dimensions affecting practical teaching quality, while practical conditions, teaching management and teaching improvement constitute important supports. The multi-subject evaluation mechanism can effectively enhance the comprehensiveness and professionalism of evaluation results, making the evaluation content more in line with post requirements. With clear structure, rigorous logic and strong operability, this system can provide a scientific basis for vocational undergraduate colleges to carry out practical teaching quality monitoring, teaching diagnosis and improvement, and resource allocation optimization. Future research can further realize the dynamic optimization of the evaluation system by combining digital teaching platforms and industry differences.

Keywords: Vocational Undergraduate Education, Practical Teaching, Teaching Quality Evaluation, Multiple Subjects, CIPP Model, AHP.

1. Introduction

With the deepening of the construction of China's modern vocational education system, vocational undergraduate education plays an increasingly prominent role in cultivating high-level technical and skilled talents. Policies such as "Twenty Guidelines for Vocational Education" and "Decision on Accelerating the Development of Modern Vocational Education" clearly require vocational undergraduate colleges to strengthen the construction of practical teaching systems, promote in-depth integration of production and education, and continuously improve students' post capabilities and professional literacy. As the core link of talent training in vocational undergraduate education, the quality of practical teaching is directly related to the generation of students' professional competence and industrial adaptability. However, the current practical teaching quality evaluation systems in colleges and universities are mostly concentrated on experimental teaching in general undergraduate education or training in higher vocational education^[1], paying insufficient attention to the characteristics of practical teaching in vocational undergraduate education, such as multi-scenario, multi-subject and multi-task.

Practical teaching in vocational undergraduate education emphasizes real situations, task-driven learning and post competence achievement, running through the entire chain of on-campus experimental training, off-campus enterprise practice, on-the-job internship, skill competitions and professional qualification certification. The traditional result-oriented evaluation method is difficult to fully reflect the

quality of practical teaching. Therefore, constructing a scientific, systematic and operable practical teaching quality evaluation system is the key to improving the teaching quality of vocational undergraduate education and promoting school-enterprise collaborative talent training^[2].

Taking practical teaching in vocational undergraduate education as the research object, this paper constructs a multi-subject collaborative practical teaching quality evaluation system combined with the CIPP evaluation model, situated learning theory and competency-based education concept. It also uses the Delphi method and AHP to determine indicator weights, aiming to provide theoretical basis and practical tools for teaching diagnosis and improvement as well as teaching management in vocational undergraduate colleges.

2. Theoretical Basis and Research Methods

2.1. Theoretical Basis

The CIPP model provides an overall framework for constructing a systematic evaluation system, building a whole-process evaluation structure for practical teaching from four dimensions: context, input, process and product. Situated learning theory emphasizes learning in real situations, which helps to improve the authenticity of task design. Competency-based education emphasizes designing courses and evaluation standards oriented to post capabilities, which is in line with the competency generation requirements of practical teaching in vocational undergraduate education. The multi-subject evaluation theory emphasizes the joint

participation of students, teachers and enterprises, which can improve the comprehensiveness and professionalism of evaluation.

2.2. Research Methods

The study adopts the literature research method to construct the initial indicator system. Two rounds of expert consultation are carried out through the Delphi method to revise the indicator content. Questionnaires are used to collect the cognition of different subjects on the importance of indicators. The AHP method is used to calculate indicator weights and conduct consistency tests to ensure the scientificity and rationality of the evaluation system^[3].

3. Construction of Practical Teaching Quality Evaluation System in Vocational Undergraduate Education

3.1. Construction Ideas and General Principles

The construction of the practical teaching quality evaluation system in vocational undergraduate education is based on the talent training objectives of vocational undergraduate education. Combined with the characteristics of practical teaching such as "real situations, skill orientation and multi-subject participation", it forms a systematic quality evaluation framework covering the entire process of practical teaching^[4]. In terms of design concept, this study takes the CIPP model as the main line, and considers the resource guarantee, teaching implementation, students' ability output and teaching improvement of practical teaching as a whole to build a "pre-during-post" whole-process quality monitoring structure.

The system design adheres to four basic principles: scientificity, orientation, operability and development. Scientificity is reflected in the full absorption of educational evaluation theory, situated learning theory and competency-based education concept in indicator design, making the system structure rigorous and logical. Orientation is reflected in the system's emphasis on the evaluation orientation of professional competence achievement and post adaptability, guiding teaching to be more in line with professional standards and industry needs. Operability is reflected in the setting of third-level evaluation observation points, making teaching evaluation have clear operational behavior indicators for teachers, students and enterprise mentors to use together^[5,6]. Development is reflected in the system's emphasis on the functions of teaching diagnosis and continuous improvement, promoting the continuous improvement of practical teaching quality through teaching reflection, curriculum reform and school-enterprise collaboration.

On this basis, this study constructs an evaluation system consisting of five first-level indicators, fifteen second-level indicators and several third-level observation points, forming a multi-dimensional, multi-level and implementable quality evaluation structure for practical teaching in vocational undergraduate education.

3.2. Design of First-level Indicators

3.2.1. Practical Teaching Conditions and Resources

This dimension focuses on the resource foundation and condition guarantee of practical teaching, which is an

important prerequisite for the smooth development of practical teaching. Its content includes the construction of training bases, equipment intact rate, the matching degree of enterprise practice posts, safety guarantee mechanisms and the sharing of school-enterprise resources. Vocational undergraduate education emphasizes production-oriented and real practical scenarios, so the adaptability of resource conditions directly affects teaching quality.

3.2.2. Practical Teaching Process

As the core dimension of the evaluation system, the practical teaching process focuses on the whole-process quality of teaching design, task execution and on-site guidance. The main content includes the authenticity and professionalism of practical tasks, the standardization of teachers' demonstration and guidance, the accuracy and safety of students' skill operations, team collaboration performance and learning process feedback mechanisms. This dimension emphasizes the concept of "learning by doing", which is an important embodiment of vocational undergraduate education's emphasis on cultivating students' practical abilities.

3.2.3. Students' Practical Competence Development

From the perspective of results, this dimension evaluates the formation of students' abilities in practical teaching, focusing on students' mastery of professional skills, problem-solving abilities, communication and collaboration abilities, professional attitude and professional literacy. At the same time, it includes the acquisition of professional qualification certificates and performance in skill competitions into the evaluation scope, so that students' ability evaluation is consistent with professional standards and industry standards.

3.2.4. Practical Teaching Management and Organization

This dimension focuses on the teaching organization, system system and management mechanism related to practical teaching, which is an important condition for ensuring the smooth implementation of practical teaching. The main content includes the implementation of teaching plans, the implementation of practical teaching syllabuses, the construction of school-enterprise collaborative talent training mechanisms, the construction of double-qualified teachers and the teaching quality monitoring system. Improve the systematicness and sustainability of practical teaching through standardized management.

3.2.5. Practical Teaching Improvement and Innovation

This dimension reflects the reflectiveness and development of practical teaching, focusing on teachers' awareness of teaching diagnosis and improvement, curriculum reform, project-based teaching promotion and the application of digital teaching tools. It also emphasizes the depth of enterprise participation in teaching, such as enterprise mentors' participation in the design, evaluation and guidance of practical projects. Promote the continuous improvement of practical teaching quality through this dimension.

3.3. Design of Second-level Indicators and Third-level Observation Points

Under the framework of five first-level indicators, this study further constructs fifteen second-level indicators and refines multiple third-level observation points to make the evaluation content specific and measurable. For example, under "practical teaching process", second-level indicators such as "task design and situational authenticity", "teachers' demonstration and on-site guidance", "students' operation

performance" and "team collaboration and communication" are set, and further refined into observable behavioral performances such as "accuracy of operation steps", "standardization of tool use", "task completion efficiency" and "safety awareness".

In the dimension of "students' practical competence development", "skill achievement", "comprehensive professional competence performance", "post adaptability" and "certificate acquisition" are taken as second-level indicators, and observation points such as completion degree, proficiency and professional attitude are further refined to make the evaluation more operable and quantifiable.

The design of third-level observation points ensures that the evaluation system can cover the key links of practical teaching, so that teachers, students and enterprise mentors have clear basis in the evaluation process, and ensure the comparability, operability and recordability of evaluation results.

3.4. Applicability and Verification Ideas of the Evaluation System

After the construction of the system, application verification and optimization are carried out through expert consultation, questionnaire survey and analytic hierarchy process. The Delphi method is used to determine the importance of indicators and ensure the logical rationality of the system. The AHP method is used to calculate the weight of each indicator to ensure the scientificity and interpretability of the evaluation system. Preliminary verification results show that "practical teaching process" and "students' practical competence development" have the highest weights in the practical teaching quality evaluation, reflecting the core characteristics of vocational undergraduate practical teaching that emphasizes process performance and ability improvement. At the same time, although "practical teaching improvement and innovation" has a relatively low weight, it is of great value in promoting the continuous improvement of teaching quality.

4. Determination and Analysis of Indicator Weights

To ensure the scientificity and rationality of the practical teaching quality evaluation system in vocational undergraduate education, on the basis of determining the system structure, this study adopts the combination of Delphi method and AHP to determine indicator weights. This method combines expert experience judgment with quantitative analysis of mathematical models, which can effectively handle the complex structure of multi-dimensional and multi-level indicators in practical teaching, and is of great significance for building a highly credible and operable evaluation system.

4.1. Determining Indicator Importance by Delphi Method

Delphi consultation aims to repeatedly evaluate the importance and rationality of indicator content through expert groups, so as to improve the scientificity and accuracy of indicator system construction. This study invited 12 experts from vocational undergraduate colleges, enterprise cooperation units and educational evaluation fields to participate in the consultation, including teaching managers, double-qualified teachers, enterprise mentors and educational

evaluation researchers, with extensive representation.

The first round of consultation adopted an open questionnaire to solicit experts' opinions on the completeness of the system, indicator settings and the operability of observation points. The research team adjusted some expressions according to the feedback, and added more professional indicators such as "depth of enterprise mentors' participation" and "post adaptability performance". The second round of consultation used a 5-point Likert scale to score the importance of indicators, and analyzed the consistency of opinions through mean value, standard deviation and coefficient of variation (CV). The results show that the CV of each first-level indicator is less than 0.20, and the CV of second-level indicators is generally less than 0.25, indicating that the experts' opinions tend to be consistent, and the indicator system has high recognition and rationality. Through two rounds of revisions by the Delphi method, the system structure is more in line with the characteristics of practical teaching in vocational undergraduate education, ensuring the scientific basis for subsequent weight analysis.

4.2. Determining Weights by Analytic Hierarchy Process

On the basis of clear indicator content, the study uses AHP to calculate the weights of five first-level indicators and their subordinate second-level indicators. The AHP method obtains the quantitative results of the relative importance of each indicator by constructing a judgment matrix and conducting pairwise comparisons.

4.2.1. Constructing Judgment Matrix and Calculating Weights

According to experts' judgments on the importance of pairwise indicators, the Saaty scale (1-9 scale) is used to construct two-level judgment matrices. When calculating indicator weights, the eigenvectors of the first-level indicator matrix and the second-level indicator matrix under each first-level indicator are solved and normalized to obtain the final weight distribution. At the same time, consistency test is carried out on the matrix. When the consistency ratio (CR) is less than 0.1, the judgment matrix is considered to have good consistency. All CR values of the judgment matrices in this study are within a reasonable range, indicating that the experts' judgments are logically consistent and the weight results are reliable.

4.2.2. Analysis of First-level Indicator Weights

The calculation results show that the weights of each first-level indicator are as follows:

Practical teaching process: 0.372

Students' practical competence development: 0.284

Practical teaching conditions and resources: 0.165

Practical teaching management and organization: 0.109

Practical teaching improvement and innovation: 0.070

It can be seen that the "practical teaching process" has the highest weight, reflecting the characteristics of vocational undergraduate practical teaching that emphasizes "learning by doing" and "promoting ability generation through process". Secondly, the "students' practical competence development" has a relatively high weight, indicating that learning output is still an important measure of practical teaching quality. "Teaching conditions and resources" and "teaching management and organization" as guarantee factors have relatively moderate weights; while "teaching improvement and innovation" is in a relatively low position, but as a key

force for promoting continuous improvement, it still maintains its due importance in the quality evaluation system.

4.3. Core Analysis of Weight Results

From the overall weight perspective, this study reflects the quality characteristics of vocational undergraduate practical teaching of "emphasizing process - emphasizing ability - emphasizing real scenarios". Firstly, the high weight of the process dimension indicates that the quality of practical teaching is more reflected in the dynamic performance such as teacher organization, student operation and team collaboration. The evaluation system should pay more attention to process indicators such as the standardization of skill operations, the effectiveness of on-site guidance and the participation in practice. Secondly, the high weight of ability development indicates that the fundamental goal of practical teaching is to improve students' ability to solve practical problems and promote the development of professional literacy.

In addition, although the weights of condition resources and management organization are relatively low, they constitute an important foundation for the smooth implementation of practical teaching. Incorporating them into the weight system can strengthen the importance of condition guarantee in quality monitoring and guide schools to continuously improve practical teaching resources and management systems. The small weight of teaching improvement and innovation reflects that this dimension is mostly a developmental evaluation, but its significance in promoting long-term quality improvement cannot be ignored.

In summary, the analysis of indicator weights not only provides a quantitative basis for practical teaching quality evaluation, but also provides a scientific reference for vocational undergraduate colleges to optimize the allocation of practical teaching resources, improve teaching organization and promote teaching reform.

5. Conclusion and Prospects

This paper constructs a practical teaching quality evaluation system for vocational undergraduate education based on multiple subjects, forming a structured model consisting of five first-level indicators, fifteen second-level indicators and several third-level observation points. The indicator weights are determined through scientific methods, making the evaluation system highly applicable and promotable. The system emphasizes process quality and ability development, reflects the essential requirements of vocational undergraduate education, and provides a systematic basis for colleges and universities to carry out

practical teaching management and quality improvement.

Future research can be further deepened in the following aspects: first, expand the sample scope and optimize the indicator content and weight structure based on application feedback from more colleges and universities; second, realize the intelligent collection and multi-dimensional analysis of evaluation data with the help of digital practical teaching platforms; third, explore industry-specific differences and construct more industry-characteristic evaluation sub-systems.

In conclusion, this evaluation system is of great significance for promoting the construction of the quality monitoring system of vocational undergraduate education, and advancing the integration of production and education as well as school-enterprise collaborative talent training.

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References

- [1] Guo Yanping, Zeng Lingyan, Zhang Kuiyan. Exploration and Practice of Process Evaluation in General Education Courses of Vocational Undergraduate Education—Taking Fundamentals of Management as an Example [J]. *The Guide of Science & Education*, 2025, (06): 67-69.
- [2] Ao Lingmin. Construction and Practical Path of Digital Transformation of Vocational Undergraduate Education Evaluation [J]. *Journal of Chongqing Open University*, 2025, 37 (01): 35-44.
- [3] Wang Jiao. Research on the Improvement Strategies and Evaluation System of Teachers' Practical Teaching Competence in Vocational Undergraduate Education [J]. *Intelligence*, 2024, (29): 129-132.
- [4] Wu Bowen. Research on the Quality Evaluation System of Practical Teaching in Vocational Undergraduate Education Based on CDIO Concept [D]. Harbin Normal University, 2024.
- [5] Luo Hongxia. Construction of Practical Teaching Evaluation System for Preschool Education Major in Vocational Undergraduate Colleges [J]. *Journal of Ningbo Polytechnic*, 2021, 25 (06): 42-46+66.
- [6] Bao Liangliang. Research on the Construction of Practical Teaching Quality Assurance and Evaluation Index System in Vocational Undergraduate Education [J]. *World of Writers*, 2021, (16): 171-172.