Innovative Research on Teaching Quality Evaluation in Vocational Colleges from the Perspective of Industry-Education Integration

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Abstract: This study addresses the issue of insufficient subject participation in teaching evaluation in vocational colleges, the standard is disconnected from practice, Core issues such as scattered data, innovatively construct a "three-dimensional linkage" evaluation model. This model involves the collaborative establishment of an evaluation system between schools and enterprises, transform corporate standards into actionable indicators, based on intelligent technology, we achieve data collection and analysis throughout the entire process, and establish a dynamic feedback mechanism to strengthen the application of results. Practice shows that, this model significantly enhances the adaptability of talent cultivation, the job competency rate of graduates has increased by 27.6%, the satisfaction of enterprises has increased by 32.4%, it provides a practical and scalable solution for the reform of vocational education evaluation.

Keywords: Vocational; Education; Teaching Evaluation; Integration of Industry and Education; Three-Dimensional Linkage; Collaborative Education

1. Introduction

In recent years, with the upgrading of China's industrial structure, the scientific construction of a quality evaluation system for vocational education is becoming increasingly crucial. February 2019, national authorities unveiled a policy framework for vocational education reform. It explicitly proposed to focus on learners' professional ethics, with technical skill level and employment quality as the core, Establish and improve a quality evaluation system for vocational education, we should improve the quality evaluation mechanism involving the joint participation of the government, industry, enterprises, vocational colleges, and other relevant entities, and actively support third-party organizations in carrying out evaluation work. It is explicitly required to improve the vocational education evaluation model, highlight the participation of enterprises. September 2020, the *Action Plan for Improving Quality and Excellence in Vocational Education (2020-2023)* issued by the Ministry of Education and other eight departments requires the establishment of an evaluation system centered on *Morality and skill cultivation, and the combination of learning and working*, Incorporate enterprise practice, vocational skill level certificate acquisition into student evaluation. Promote the "credit bank" system, realize digital certification and conversion of learning outcomes; build a big data center for vocational education, Collect and analyze data related to teaching, practical training, and employment, Provide a basis for evaluation. The *Overall Plan for Deepening the Reform of Education Evaluation in the New Era* Zhong fa [2020] No. 19proposes to eliminate the tendency of "only focusing on scores and only focusing on further education", the focus of evaluation in vocational education has shifted to the effectiveness of industry-education integration and students' professional abilities. The newly promulgated *Vocational Education Law of the People's Republic of China* in 2022 clearly stipulates that, Vocational schools should improve the education quality evaluation system, Involve industry organizations, enterprises, etc. in the evaluation, employment orientation should be highlighted, take the professional ethics, technical skill level, and employment quality of the educated as important indicators, guide vocational schools to cultivate high-quality technical and skilled talents. The promulgation of the Vocational Education Law further regards professional ethics, technical skills, and employment quality as core evaluation indicators. However, currently, there are still practical issues in the

evaluation of vocational colleges, such as a single evaluation subject, standards biased towards theory, and weak data application, it restricts the improvement of talent cultivation quality.

This study takes equipment manufacturing majors as an example, Explore innovative paths for teaching evaluation in the context of industry-education integration. Through literature analysis, field research and case studies, focusing on three major challenges: diversified collaboration among evaluation subjects, reconstruction of standard capabilities and dynamic data management, Promote theoretical construction and empirical testing in stages. The intelligent evaluation system developed possesses two innovations: First, we should establish a diversified and collaborative mechanism, expand evaluation dimensions; second, relying on big data analysis, realize the transformation of evaluation from empirical judgment to intelligent diagnosis. This scheme has achieved remarkable results both in theory and practice, it has promotional value.

2. The Current Situation and Challenges of Teaching Evaluation in Vocational Colleges

2.1 The Simplification of Evaluation Subjects

The current evaluation is still teacher-led, the participation of multiple stakeholders, such as students' self-assessment and enterprise evaluation, is insufficient, it is difficult to form a multi-dimensional and three-dimensional evaluation perspective. Over-reliance on traditional methods such as student evaluation of teaching and supervisory observation, the comprehensive evaluation of teaching process, learning outcomes and professional ability development is relatively weak. The evaluation indicators are not closely aligned with industry technical standards, the depth and breadth of enterprise participation in evaluation are limited, this results in the evaluation outcomes failing to truly reflect the competency requirements of the position. The current update mechanism of the evaluation system is not sound, lagging behind the industry development speed, this results in a disconnect between talent cultivation and the actual needs of enterprises. The current teaching evaluation work in vocational colleges relies excessively on in-school teachers, the participation of industry enterprises is significantly insufficient. Research data shows that, Among the 35 sampled higher vocational colleges, the average proportion of enterprise scoring in course assessment is only 12.3%, and the evaluation method is superficial. Taking the electromechanical major in a certain vocational college as an example, the weight of enterprise evaluation is only 10%, the main manifestation is the simple signature confirmation of the internship unit's head on the assessment form, this formalized assessment is difficult to objectively reflect students' actual professional competencies. The reasons for this current situation can be summarized into three aspects: institutional absence, 82% of the sampled colleges and universities have not yet established a standardized school-enterprise collaborative evaluation mechanism; standard disconnection, about 70% of the interviewed enterprises believe that the current evaluation indicators cannot accurately measure students' practical operation abilities; the cost factor cannot be ignored either. When conducting cross-regional assessments, the per capita participation cost for enterprises exceeds 300 yuan [1].

This singularized evaluation model leads to significant deviations between the assessment results and the actual job requirements. To improve this situation, it is urgent to carry out systematic reforms from two dimensions: institutional innovation and technology empowerment. The current evaluation model of vocational colleges has obvious deficiencies, Its simplistic evaluation method not only leads to a 20% to 35% deviation between the evaluation results and the actual job requirements, It seriously affects the pertinence of talent cultivation, furthermore, approximately 36% of the internship evaluation forms were filled out by others, rendering the enterprise evaluation ineffective in providing diagnostic insights, As pointed out by the HR head of a well-known manufacturing enterprise, the existing evaluation model struggles to accurately identify suitable talents therefore, effective measures need to be taken to establish a diversified evaluation mechanism, by increasing the weight of enterprise evaluation to over 30% and utilizing digital technology to reduce participation costs, Ultimately, effective alignment between industrial needs and talent cultivation is achieved [2].

2.2 Theorization of Evaluation Criteria

It still primarily relies on traditional methods such as exams and homework, Lack of procedural and dynamic evaluation methods. Although some institutions have introduced digital platforms, however, data analysis is often limited to basic statistics, failed to effectively utilize intelligent technology to achieve deep mining and trend prediction of learning behaviors. The current evaluation model of vocational colleges exhibits a pronounced tendency towards theoretical orientation, the main manifestation is an excessive reliance on written exams, coupled with a severe lack of practical evaluation, According to research data, the average proportion of theoretical assessment in electromechanical majors is 65.8% (some institutions even reach up to 70%), while practical assessment only accounts for about 30%,This imbalance not only leads to the widespread phenomenon of "high scores but low abilities", This has led to a prominent issue of insufficient job adaptability among graduates [3].

The root of the problem primarily manifests in three key aspects: there is a serious disconnect between evaluation criteria and corporate technical standards (only 28% of institutions incorporate industry norms into their assessments), practical assessments exhibit fragmented characteristics (82% of practical evaluations lack systematicness), and standard updates are significantly lagging behind (67% of professional assessment standards have a revision cycle exceeding 3 years), this directly leads to the feedback from enterprises indicating that graduates require an average of 3 -6 months of retraining to become competent for basic positions, therefore, it is recommended to reconstruct the evaluation model, by increasing the proportion of practical assessment to over 50%, establishing a dynamic adjustment mechanism that synchronizes with enterprise technical standards, and strengthening process evaluation, It effectively embodies the competency-based characteristics of vocational education [3].

2.3 Fragmentation of Data Application

Evaluation data is isolated, and evaluation results lag behind the teaching process, Students find it difficult to optimize their learning strategies in a timely manner, it is also difficult for teachers to adjust their teaching methods in a timely manner. Meanwhile, the evaluation criteria are updated slowly, they are unable to quickly adapt to the new requirements for teaching posed by new technologies and processes. The current teaching evaluation work in vocational colleges faces significant information coordination challenges, it has restricted the improvement of talent cultivation quality. According to a survey conducted on 35 higher vocational colleges, about 90% of institutions have "system isolation" between their educational administration platforms and enterprise databases, there are structural barriers to data flow [4]. For example, a college under the "Double High Plan", Due to the inconsistency in data standards between the teaching system and the enterprise employment system, it is difficult to effectively share students' growth records at school.

The dilemma of information coordination is mainly reflected in three aspects: there is a lack of unified data standards within the school, with key information such as teaching, practical training, and employment scattered across multiple independent systems, It is difficult to form a complete portrait of students' abilities; the data channel between schools and enterprises is not smooth, Only a few colleges and universities have established standardized information exchange mechanisms with employers; the tracking system for graduates is weak, Over 80% of institutions still collect employment data through sampling, the information is lagging and lacks representativeness[5],

Data fragmentation has already had a substantial impact. Only 65% of our school's graduates in the past three years have been engaged in their major fields of work, the employment rate for graduates majoring in industrial robotics is as low as 48%. More graduates were tracked and shown after three years, 34% of career changers point out that "there is a significant gap between what they learned in school and the job requirements"[3].

The root of the problem lies in: Insufficient awareness of data sharing (62% of faculty members lack a data-driven philosophy), weak technical support (91% of institutions do not have a professional data analysis team), and lack of institutional safeguards (only 7% of institutions have formulated systematic data management methods). The key to cracking lies

in: Build a unified data platform to integrate internal systems within the school, establish a mechanism for data sharing between schools and enterprises, improve the tracking system for all graduates, Cultivate a professional data analysis team. Only by breaking down data barriers, only then can we achieve empirical-based teaching improvement and professional optimization [6].

3. Innovative Framework for Intelligent Teaching Evaluation Model

3.1 Theoretical Innovation: Multi-Dimensional Collaborative Evaluation Model

Based on the educational philosophy of "student -centeredness", A "four-dimensional" intelligent teaching evaluation model covering four dimensions: evaluation subject, data source, analysis technology and feedback mechanism, has been constructed. This model integrates multiple evaluation subjects, aggregates multi-source teaching data, employs intelligent analysis methods and establishes a dynamic feedback mechanism, it aims to achieve multi-dimensional and precise evaluation of the learning process [7]. The four key components it comprises, namely the subject dimension, data dimension, technology dimension and feedback dimension, work synergistically, jointly promote the scientificity and effectiveness of evaluation, Provide systematic solutions for enhancing the quality of vocational education teaching.(As shown in table1)

Table 1. "Four-Dimensional Integrated" Evaluation Model Table

dimension	component elements	main functions
main dimension	School teachers, enterprise mentors, student self-assessment and third-party evaluation institutions	Achieve collaborative participation from multiple stakeholders to ensure the comprehensiveness and objectivity of the evaluation.
data dimension	Classroom performance data, practical training operation data, enterprise internship data and career development data	Integrate learning behavior data across the entire process to build student competency profiles.
technical dimension	AI behavior analysis, big data mining, virtual simulation technology, intelligent matching algorithm	Analyze the correlation between learning behavior and job competency to achieve precise evaluation.
feedback dimension	Real-time diagnostic reports, personalized improvement suggestions, teaching adjustment plans and standard optimization mechanisms	Form a closed loop of "evaluation-diagnosis-improvement-optimization" to promote continuous improvement in teaching and evaluation.

3.2 Implementation Path

This study proposes a "trinity" practical approach, build an intelligent teaching evaluation model through embedding enterprise standards, empowering with digital technology and establishing a closed-loop feedback mechanism. (As shown in figure1).

In terms of embedding enterprise standards, the DACUM analysis method is employed to systematically decompose the capability requirements of typical positions, Convert enterprise technical standards into quantifiable evaluation indicators. Taking the major of numerical control technology as an example, Refine "CNC machining accuracy" into five secondary indicators, including "Dimensional tolerance control compliance rate" and "Surface roughness qualification rate", and set specific parameter standards such as a 0.1mm tolerance zone.

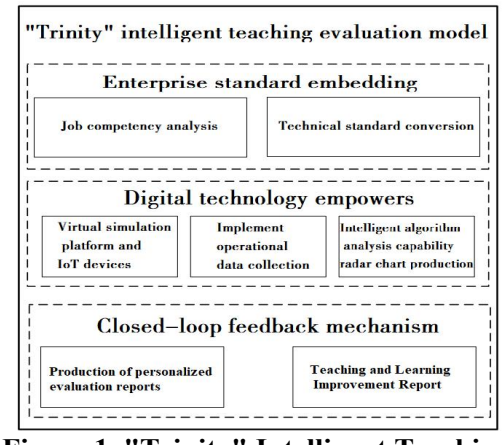

Figure 1. "Trinity" Intelligent Teaching Evaluation Model

In terms of digital technology empowerment, relying on virtual simulation platforms and IoT devices, collect student operation data in real

time. By analyzing over 120 behavioral characteristics during the training process using intelligent algorithms, automatically generate a radar chart of abilities encompassing dimensions such as professional skills and professional ethics. The application in a pilot institution shows that, this technology has increased the efficiency of practical evaluation by 40%, the objectivity of evaluation has increased by 35%.

Our virtual simulation platform can monitor students' operations in practical courses in real-time, for example, if it is noticed that a certain student performs poorly in the "Circuit Fault Diagnosis" course, It will quickly deliver personalized and customized educational videos and simulation exercises. From the perspective of practical application effects, not only has the pass rate of students' practical assessments increased by about 28%, crucially, the time required for them to acquire professional skills has been reduced by 30% [8].

4. Implementation Effectiveness and Case Analysis

4.1 Implementation Effectiveness Analysis

In recent years, we have collaborated with the Mechatronics program at a certain vocational college to carry out an innovative teaching evaluation practice, the time span spans from September 2022 to July 2023. This experiment covered 482 students from 12 classes across three grades, at the same time, eight industry-leading enterprises were invited for in-depth cooperation [9], by systematically comparing the data before and after the implementation of the reform, the results showed significant improvements across multiple core dimensions.

The effectiveness of this teaching evaluation reform is indeed heartening. The most prominent change lies in the significant increase in the enthusiasm for participation from the enterprise side, the proportion of scores from enterprises has skyrocketed from the initial 12% to 40%.It is worth noting that, Not only has the number of enterprises participating in cooperation increased, these enterprises have also substantively participated in core teaching processes such as curriculum system development, practical training program formulation, and graduation assessment. What is particularly noteworthy is that, five industry benchmark enterprises have directly introduced their complete employee performance evaluation mechanisms into teaching evaluation models, taking a well-known intelligent manufacturing enterprise as an example, the company has integrated the complete professional qualification standards for its "Industrial Robot Debugging Engineer" into the curriculum evaluation plan. This deeply integrated school-enterprise collaboration model, it has brought about a substantial breakthrough in the innovation of evaluation models [9].

In terms of enhancing students' practical abilities, we have implemented an important reform: Increase the proportion of practical assessment from 35% to 60%, at the same time, an evaluation framework encompassing three levels: basic operational ability, comprehensive problem-solving ability, and innovative practical ability, has been established. the implementation effect shows that, the frequency of awards won by the reformed student group in provincial skill competitions has increased by 25%, the winning rate of the "Industrial Robot Technology Application" competition unit has jumped from the original benchmark to 32%, this increase is indeed considerable [9].

In terms of data application, this study achieves full coverage of employment quality tracking by establishing a graduate career development database, the data shows that the employment rate of 2023 graduates in their corresponding majors reached 92% (an increase of 18 percentage points compared to before the pilot program), In particular, the job adaptation pass rate of graduates within three months of employment has increased from 68% to 89%, and the enterprise satisfaction score has improved by 22 points, these data fully verify the effectiveness of the intelligent evaluation model in enhancing the quality of talent cultivation [9]. (As shown in figure 2).

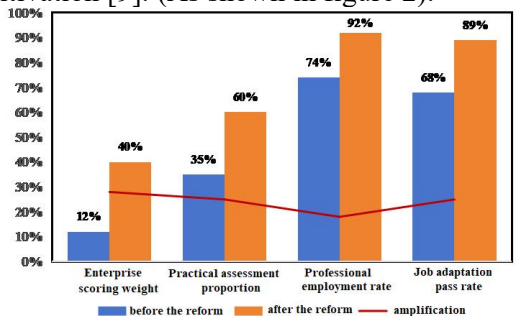

Figure 2. Comparison Chart of Data on the Implementation of Teaching Evaluation Reform

4.2 Typical Case Analysis

Case 1: Practice of evaluation reform in the major of numerical control technology

This study collaborates with XX Precision Manufacturing Co., Ltd. to carry out the reform practice of professional evaluation in numerical control technology, by transforming typical enterprise parts processing projects (such as "reducer housing processing") into teaching evaluation tasks and breaking them down into 6 ability modules including process planning, program writing, machine tool operation, and 21 specific evaluation indicators, With the full participation of enterprise technical backbones in the evaluation process and the implementation of a dual-element scoring mechanism involving "school teachers + enterprise mentors", after the reform, data showed that the compliance rate of student operational standards significantly increased from 75% to 90% (with the dimensional accuracy control pass rate increasing by 28 percentage points)[10], what's more noteworthy is that the pass rate of graduates during their probation period in this company has increased from 60% to 85%, fully demonstrate the role of evaluation reform in promoting the quality of talent cultivation.

Case 2: Exploration of professional intelligence evaluation for industrial robots

Based on the college's virtual simulation platform, this study has constructed an intelligent evaluation system comprising 128 sensor nodes, in simple terms, this system is, it mainly helps us solve two major problems: Firstly, the system will automatically track and record the entire operation process of the students, Including programming, debugging, and troubleshooting, Then generate an intuitive capability analysis diagram, clearly display students' homework efficiency, operational accuracy, and standardization level; Secondly, we have also designed a dedicated analysis interface, Enable teachers to quickly identify weak links in their teaching. In practical use, the most direct change is that the time for students to master professional skills has been significantly shortened, the duration has decreased from 4.2 weeks in the past to 2.9 weeks now, the learning efficiency has increased by nearly one-third. Especially in the key course of robotic arm path planning, the excellence rate has seen a significant increase from the original 38% to 65%, this progress is truly surprising. In addition, the system automatically collects and analyzes evaluation data, it has provided an important basis for the construction of our major, the update cycle of course content has been shortened from 18 months to 6 months, it is much more flexible to adjust [10,11].

5. Conclusion

After two years of solid practical exploration, the intelligent evaluation system for vocational colleges we have developed effectively integrates industrial needs with digital technology. This system promotes the increase of the weight of enterprise expert scoring to 40%, the proportion of practical assessment is 60%, increase the number of awards won by students in skill competitions by 25%; by integrating multi-source data, the professional match rate for graduates has increased by 18%. Pilot proves, the system has established a closed-loop mechanism of "teaching-evaluation-improvement", the satisfaction of employers has increased by an average of 22 percentage points, it provides an effective solution for industry-education integration.

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References

[1] Zhu Dequan, Gao chan.2025.What Kind of Vocational Education Evaluation Reform is Needed in the New Era? 24(06):3-14. Journal of Shenzhen Polytechnic University, 24(06):3-14.

[2] Miu Hongjie, Huang, Zhenzhen, Zhen Xuangong. 2025, Evaluation analysis of practical courses in civil engineering from a multi-dimensional assessment perspective——Taking "Engineering Drawing Course Design" as an example. Anhui Architecture, 32(12):124-126.

[3] Xiao Yongfeng. 2017, A Study on the Evaluation Method of the Ancient Chinese Curriculum Based on the Training Target of Applied Talents Applied Talents—Case

Study on the School of Literature and Journalism of Liupanshui Normal University. Journal of Liupanshui Normal University, 29(06):64-67.

[4] Yang Xianmin, Zhao Luyao, Li Xin et al. 2024, How to Evaluate the Performance of Educational Data Applications? Analysis Guided by the 3E Theory. Chinese Journal of Distance Education, 44(05):51-61.

[5] Yu Juhua, Hu Chunfeng, Long Xiaohan et, al. 2025, Research on the Reform of Teaching Evaluation in Higher Vocational Information Technology Courses Empowered by Digital Intelligence: Taking Operating System Security Configuration Course as an Example. Journal of Changzhou College of Information Technology, 24(02):28-34.

[6] Ministry of Education Guiding Opinions on Accelerating the Development of Informatization in Vocational Education. 2022-06-10.

[7] Jiang Yigang, Jiang Lili, 2025, Research on the Path of Collaborative Participation by Multiple Stakeholders in Educational Evaluation of Higher Vocational Colleges——Based on the background of industry-education integration. Modern Business Trade Industry, (21):10-12.

[8] Zhu Xiaoling, Liang Xiangbo, 2025, Research and Practice of Professional Construction Evaluation System Based on the "Trinity" Model——Taking higher vocational colleges in southern Henan as an example. Journal of Taiyuan Urban Vocational College, (09):7-9.

[9] Su Zeting, Huang Zhibing, Tu Peizheng, 2025, Research on the Innovation Paradigm of College Teacher Evaluation System Empowered by Digital Technology. Journal of NingBo Institute of Education, 27(06):57-64.

[10] Wang Tao, Zhang Wei, 2021, Research on the Multi-party Evaluation Mechanism of CNC Professional Courses in Secondary Vocational Education under Modern Apprenticeship System. Agricultural Machinery Using & Maintenance, (05):129-130.

[11] Jiao Minglian, 2025, Construction of teaching supervision system in universities under the background of a new round of educational teaching review and evaluation. Technology Wind, (33):30-32.

