

# Design and Implementation of the Teaching Quality Evaluation Data Platform of Teachers' Teaching Innovation Team in Vocational Education

Qiming Tian, Shunda Cai\*, Wanle Chi, Dafeng Gong

Wenzhou Polytechnic, Wenzhou, China

\* Corresponding author: Shunda Cai

**Abstract:** Teaching is the core of all teachers' work in vocational education, and improving the teaching quality is the key link to improve the overall education quality of teachers' teaching team. It is an important starting point for teachers' teaching construction to promote teaching through reasonable teaching quality evaluation. However, the evaluation of teaching quality in vocational education is a complex and multidimensional process, covering multiple roles and rich data dimensions. How to establish an objective and comprehensive evaluation system, and use the advanced information system for the implementation of data collection work is a problem to be solved. A dynamic and multi-dimensional data platform designed in this paper realizes the collection and processing of teaching quality evaluation. Through the platform, the data of different teaching quality evaluation subjects are collected, and the teaching team is evaluated after comprehensive analysis and treatment. After empirical evaluation, the platform shows that the platform evaluation effect is good.

**Keywords:** Teaching Quality Evaluation, Multi-dimensional Analysis, Data Platform, Hierarchical Analysis Method.

## 1. Background

Teaching is the core of all teachers' work in vocational education, and improving the teaching quality is the key link to improve the overall education quality of teachers' teaching team. How to evaluate the performance of a teacher's teaching team, the teaching quality evaluation is a necessary part. It is of great significance to study the teaching quality evaluation system and establish an effective evaluation platform to improve the teaching quality and the overall school-running level of the team.

In the classroom teaching practice of vocational colleges, due to the lack of clear and systematic evaluation index and evaluation system, it is difficult to effectively implement the evaluation of teaching quality effectively. It is particularly important to construct a set of perfect teaching quality level evaluation index system. This is not only helpful to accurately evaluate the teaching information level, but also to deeply guide and promote the process of teaching information construction in colleges and universities. Through systematic analysis of the evaluation process, clear evaluation criteria and necessary adjustment, the teaching quality of vocational colleges can be effectively improved and promote its steady development<sup>[1]</sup>.

Many scholars have studied the evaluation system of teaching quality in higher education. Yu Jian et al. On the multi-dimensional classroom teaching quality evaluation system conducted in Civil Aviation University of China<sup>[2]</sup>. Yu Junli used the fuzzy evaluation method to design the teaching quality evaluation system<sup>[3]</sup>. On the basis of the construction requirements of the digital campus, Yan Chaosheng et al. put forward the functional requirements and architecture structure of the teacher teaching quality evaluation system based on the Web<sup>[4]</sup>. Faham Using the fuzzy comprehensive evaluation method to study the mechanism of the sustainable development of higher education, and put forward the corresponding mathematical evaluation model<sup>[5]</sup>. Xue Shaowen used the method of intuitive fuzzy hierarchy to entropy weight analysis to quantitatively evaluate the teaching quality<sup>[6]</sup>. Jing Wenli analyzed the influence of curriculum resources, interactive functions, information management and other means on teaching to evaluate the teaching quality<sup>[7]</sup>. Sauerman Analyzed the student evaluation of 19,952 university teachers and obtained the different effects of gender factors on the evaluation of teaching quality<sup>[8]</sup>. Ahmad studied how to improve student responsiveness to the evaluation of teaching course quality<sup>[9]</sup>.

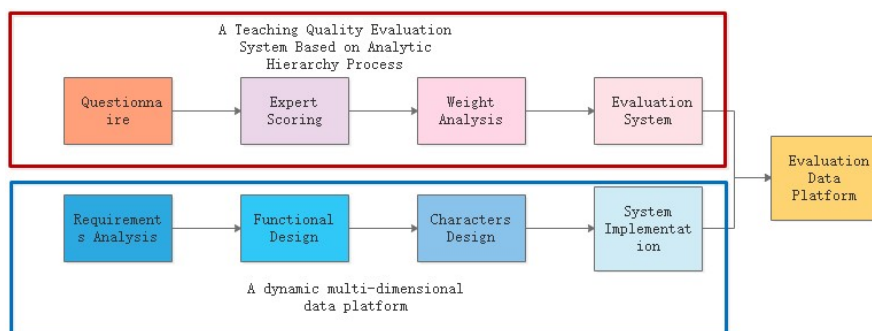


Figure 1. Data Platform Framework

In the construction of the teacher teaching team, how to evaluate the reform effect and the performance of the innovation team is an important topic. This paper as a national vocational education teacher teaching innovation team professional one of the achievements of the research project, Wenzhou vocational and technical college big data technology professional innovation team in Hebei software vocational colleges and China united network communication co., LTD., etc, on how to evaluate the vocational education teachers teaching innovation team teaching quality, designed a dynamic dimensions of data platform, through the platform to the teacher teaching team teaching quality from the original qualitative evaluation into a more accurate quantitative evaluation.

Firstly, this paper uses the fuzzy evaluation method to

quantify the qualitative factors in the teaching quality evaluation, and constructs a teaching quality evaluation system based on hierarchical analysis. This paper designs and implements a dynamic multi-dimensional data platform. By combining the calculation results of the evaluation system with the evaluation data platform, we establish a multi-subject and multi-dimensional evaluation system for the teacher teaching team, as shown in Figure 1.

## 2. A Teaching Quality Evaluation System based on Hierarchical Analysis

**Table 1.** The Teaching Quality Evaluation System Based on Analytic Hierarchy Process

Level 1	Level 2	Level 3	Weight	Evaluator	
1. Invest	1.1 Funds	1.1.1 Special Funds	0.01207	Team Leader	
		1.1.2 Construction Funds	0.00760	Team Leader	
		1.1.3 Personnel Funds	0.00479	Team Leader	
	1.2 Teachers	1.2.1 Professional Title	0.01852	Evaluation organization	
		1.2.2 Dual-competency	0.03115	Evaluation organization	
		1.2.3 Age	0.00636	Evaluation organization	
		1.2.4 Teaching years	0.01069	Evaluation organization	
	1.3 Training Rooms	1.3.1 Training Equipment	0.01281	Team members	
		1.3.2 Training Management	0.00641	Team members	
	1.4 Teaching Resources	1.4.1 Management System	0.00492	Team members	
		1.4.2 Course Resources	0.00984	Evaluation organization	
	1.5 Classroom	1.5.1 Smart Classrooms	0.00756	Team Leader	
		1.5.2 Video Classroom	0.00378	Team Leader	
	2. Process	2.1 Atmosphere	2.1.1 Engagements	0.00126	Supervisor
			2.1.2 Learning Habits	0.01278	Supervisor
2.1.3 Professional Atmosphere			0.00656	Supervisor	
2.1.4 Teacher-student interaction			0.00408	Supervisor	
2.1.5 Controllability			0.00939	Supervisor	
2.2 Content		2.2.1 Clarity	0.01187	Supervisor	
		2.2.2 Rationality	0.02665	Supervisor	
		2.2.3 Teaching Priorities	0.01869	Supervisor	
		2.2.4 Teaching Difficulties	0.00919	Supervisor	
		2.2.5 Correlation Between Theory And Practice	0.01139	entrepreneur	
		2.2.6 Richness	0.01869	Supervisor	
		2.2.7 Suitability	0.00574	Supervisor	
2.3 Methods And Means		2.3.1 Information Means	0.05110	Supervisor	
		2.3.2 Political Affairs	0.01703	Supervisor	
		2.3.3 Differentiation	0.01703	Supervisor	
	2.3.4 Experience	0.01703	Supervisor		
3. Effect	3.1 Teaching Ability	3.1.1 Achievements	0.05007	Evaluation organization	
		3.1.2 Teaching Reform Fund Projects	0.16533	Evaluation organization	
		3.1.3 Promotion	0.04549	Team Leader	
	3.2 Innovation And Entrepreneurship Ability	3.2.1 Social Service	0.01332	entrepreneur	
		3.2.2 Entrepreneurial enthusiasm	0.00283	Team Leader	
		3.2.3 Creative Activity	0.00283	Team Leader	
		3.2.4 Social Practice	0.01332	entrepreneur	
		3.2.5 Creative Validity	0.00614	Team Leader	
	3.3 Satisfaction	3.3.1 The Teaching Process	0.02504	Graduate	
		3.3.2 Teaching Attitude	0.02504	Graduate	
		3.3.3 The Teaching Effect	0.02504	Graduate	
		3.3.4 Teaching Resources	0.02504	Graduate	
	3.4 Employment	3.4.1, Employment Rate	0.01447	Team Leader	
		3.4.2 Corresponding Rate	0.04240	Team Leader	
		3.4.3 Employment Treatment	0.02519	Team Leader	
3.4.4 Employers Satisfaction		0.06807	entrepreneur		
3.4.5 Career Promotion		0.01447	Team Leader		
3.5 Competition	3.5.1 Students Prizes	0.02708	Evaluation organization		

	3.5.2 Teachers Prizes	0.02708	Evaluation organization
	3.5.3 International Prizes	0.00677	Evaluation organization

Through communication with cooperation colleges and enterprise research, widely solicit the opinions of education experts, frontline teachers, enterprise representatives and students, this article around the teacher innovation team teaching quality, teaching in vocational education from teaching input, teaching process and teaching results three core dimensions, build a contains 73 specific indicators of teaching quality evaluation system, covers the 18 indicators of teaching input, 22 indicators of teaching process, and 33 indicators of teaching effectiveness, teaching such as funding, faculty investment, classroom atmosphere, teaching content, etc., to ensure the evaluation of comprehensive.

The questionnaire was issued to the above index system. Based on the three dimensions of teaching input, teaching process and teaching effect, the principal component analysis technology has successfully extracted the key factors affecting the teaching quality, and the final index system of teaching quality evaluation is further determined. This system consists of 3 first-level indicators, 13 second-level indicators and 49 three-level indicators. At the same time, it determines the evaluation subject and specific evaluation standard of each index, realizing the transformation from qualitative index to quantitative index.

To more accurately assess the importance of each indicator, experts in relevant fields were invited to score. With the help of the hierarchical analysis model, the judgment matrix is constructed, and the weight of each evaluation index is determined accordingly. Finally, a complete teaching quality evaluation index system of innovative team has been successfully constructed, which provides powerful tools and support for the teaching quality evaluation of vocational education. The evaluation system also sets the classification standard, which divides the evaluation results into four grades:

"very good", "good", "general" and "bad", which are easy to directly reflect the teaching quality level of the teacher team. The research results of this evaluation index system provide a quantifiable and comparable evaluation tool for the teaching quality of the vocational education teacher team. The evaluation index system of teaching quality is shown in Table 1.

### 3. Dynamic and Multi-dimensional Data Platform

Vocational education focuses on cultivating students' practical skills and professional qualities, emphasizes the combination of theory and practice, closely connects with the industry, and focuses on employment orientation and lifelong learning. Therefore, the teaching evaluation platform needs to fully consider these characteristics, support practical teaching evaluation, reflect industry standards, and promote sustainable career development. The teacher teaching innovation team plays a key role in promoting teaching method innovation, curriculum content update and application of teaching technology. They need a flexible, intelligent platform that can support in-depth analysis to promote teaching innovation practice.

This paper designs a dynamic multi-dimensional data platform to realize the collection and processing of teaching quality evaluation, and carries out data collection and quantitative evaluation of teaching quality evaluation subjects in different ways through the platform.

The platform adopts a 5-layer architecture, using the cloud or an independent server to connect with the main database, file objects and cache data. The structure is shown in Figure 2.

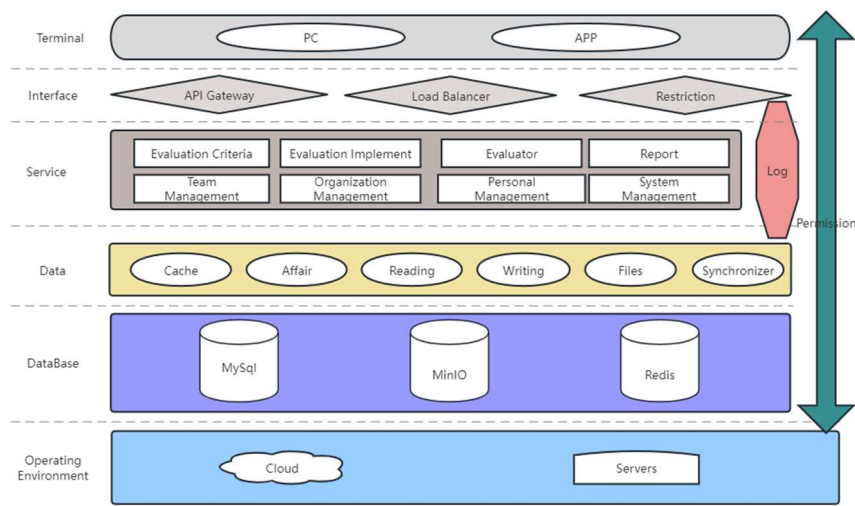


Figure 2. System structure diagram of the dynamic and multi-dimensional data platform

The access terminal layer includes two parts: PC terminal and mobile client, providing entry for user access to the system. By supporting access to different devices, users can use the system at any time and anywhere, achieving a flexible use experience. This design can meet the needs of teachers

and managers in different environments, and improve the convenience of the use of the system.

The API interface layer is responsible for managing the access and distribution of client requests, including three modules: API gateway agent, load balancing, and service

circuit breaker. The API gateway agent ensures that the request is quickly and accurately routing to the corresponding service, the load balance allocates the request load to improve the system response speed and stability, and the service circuit breaker cuts off the fault service when the service fails to ensure the high availability of the system. This layer is the "gatekeeper" of the system, ensuring the smooth and security of requests.

The service layer is the core of the system, which is responsible for the implementation of specific business functions. It includes modules such as standard formulation, evaluation implementation, team management, organization management, evaluation service, evaluation report, personal management and system management. These modules work together to ensure that all aspects of teaching quality evaluation can operate efficiently and seamlessly. Through these service modules, the system can realize the comprehensive evaluation and management of the teaching quality.

The data layer is responsible for the storage and management of data, including data cache, transactions, read and write database, cache expiration control, file read and write, and data synchronization modules. The data layer ensures efficient storage and reading of data and maintains data consistency and integrity. Through the caching and synchronization mechanism, the data layer improves the response speed and reliability of the system, ensuring that the data can timely and accurately support the upper layer service.

The database layer consists of a relational database (MySQL), a file object store (MinIO), and a cached database (Redis). Relational database is used to store structured data to support complex query and transaction management; file object storage is used to manage large files and object data; and cache database is used to cache high-frequency access data to improve system performance. These database modules together constitute the data basis of the system, and ensure the persistence and efficient access of the data.

The operating environment layer includes cloud hosts and standalone servers that provide the hardware and infrastructure needed for the system to run. Cloud hosts provide flexible and scalable computing resources to adapt to

dynamic expansion and load changes; independent servers provide high performance and dedicated computing resources to ensure the stability and security of the system. By combining cloud hosts and standalone servers, the system can strike a balance between flexibility and reliability.

Logging and permission control are the safeguards of system operation. The logging module records all kinds of log information during the process of the system operation, which helps to monitor the system operation status and troubleshoot; the permission control module manages the rights of users and roles to ensure the system security and data confidentiality. These measures jointly maintain the stability and security of the system, ensure the privacy of user data and the transparent traceability of system operations.

The overall architecture design fully considers the complexity and diversity of the teaching quality evaluation system of vocational education teachers, and realizes the high efficiency, flexibility and scalability of the system through hierarchical and modular design. Each level and module are clear and clear to ensure that the system can operate stably and reliably, and provide convenient and efficient services for users.

#### 4. Vocational Education Teachers Teaching Innovation Team Teaching Quality Evaluation Data Platform Realization

The teaching quality evaluation data platform is divided into three modules: evaluation management, organization management and system management; main functional module evaluation management includes my evaluation, evaluation criteria and evaluation implementation, which can be calculated dynamically by setting different evaluation criteria; organization management includes managing evaluation team, evaluator and different roles for multiple subjects and dimensions; system management includes management and tracking of menu, dictionary, parameters and log, such as Figure 3.

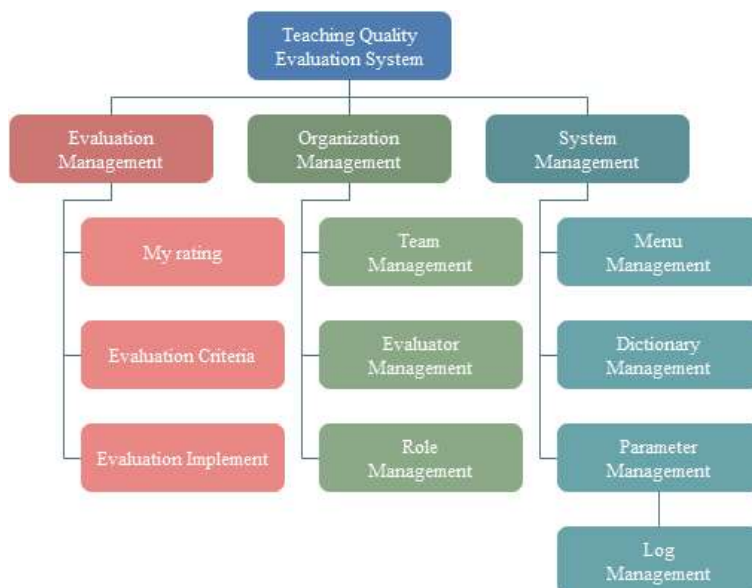


Figure 3. Functional structure diagram of the teaching quality evaluation data platform of the teaching innovation team of vocational education teachers

The main functions of the platform are realized in the evaluation management, including my evaluation, evaluation criteria, and evaluation implementation. The following are the specific introduction and screenshots of each functional module.

(1) My evaluation

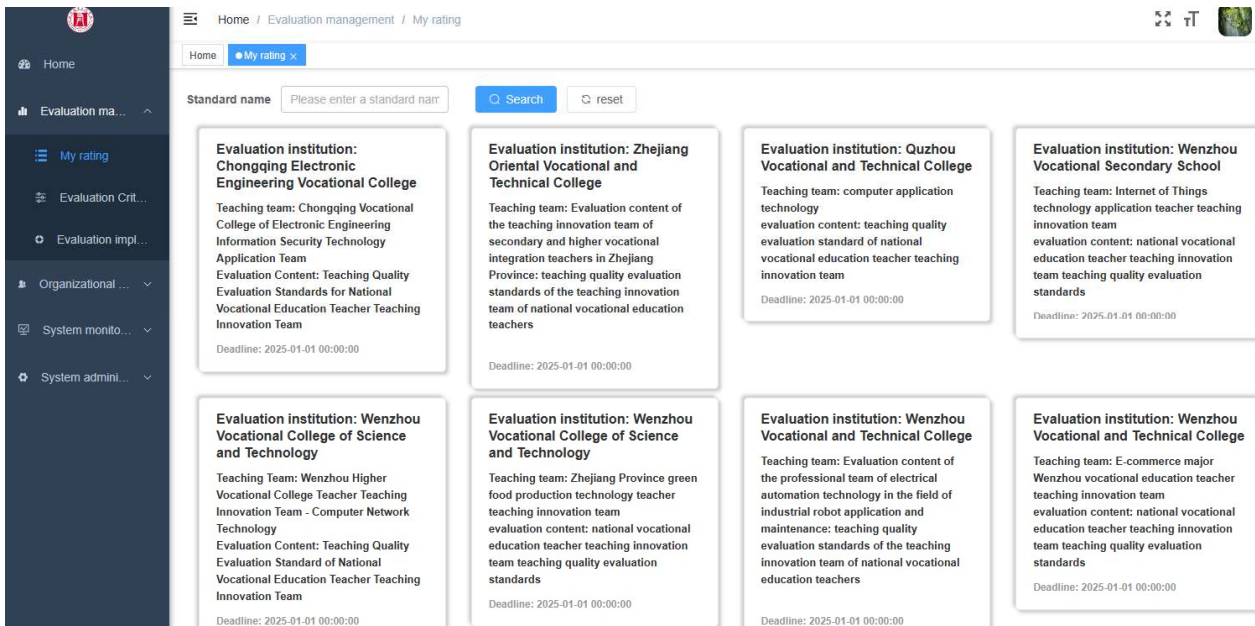


Figure 4. Myrating

(2) Evaluation criteria

To realize the formulation of teaching quality evaluation index system standards, allow the evaluation organizer to set the teaching quality evaluation index tree, and can flexibly set

Users use the entrance to evaluate the teaching quality refinement index, and use the business engine to automatically calculate the current user adaptation index, so as to realize an evaluation standard of thousands of people. After opening the evaluation content, display the interface as shown in Figure 4.

the evaluation index weight, evaluation subject, evaluation type and other personalized evaluation index attributes of specific underlying indicators, as shown in Figure 5.

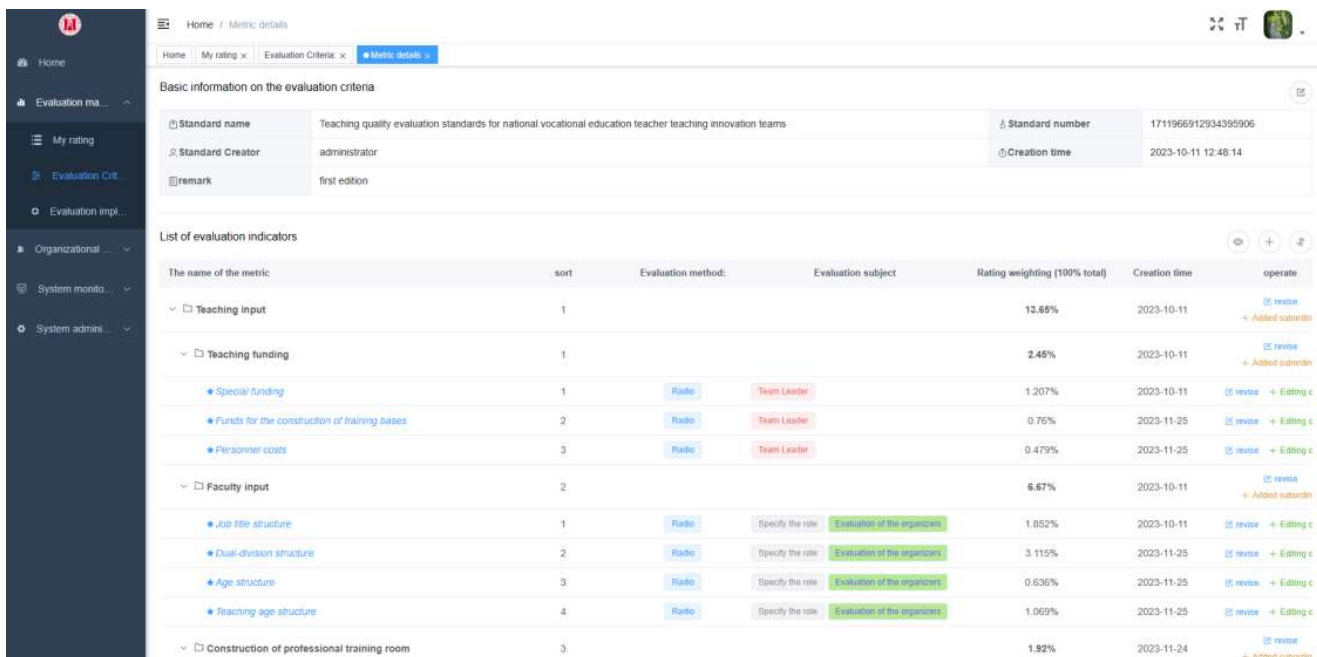


Figure 5. Evaluation Criteria

(3) Evaluation and implementation

Provide the evaluation organization policy for the evaluation and implementation of any evaluation standard, including setting the evaluation implementation window for

the evaluation implementation scope, and view the implementation progress of any team within the implementation scope, and conduct data analysis, as shown in Figure 6.

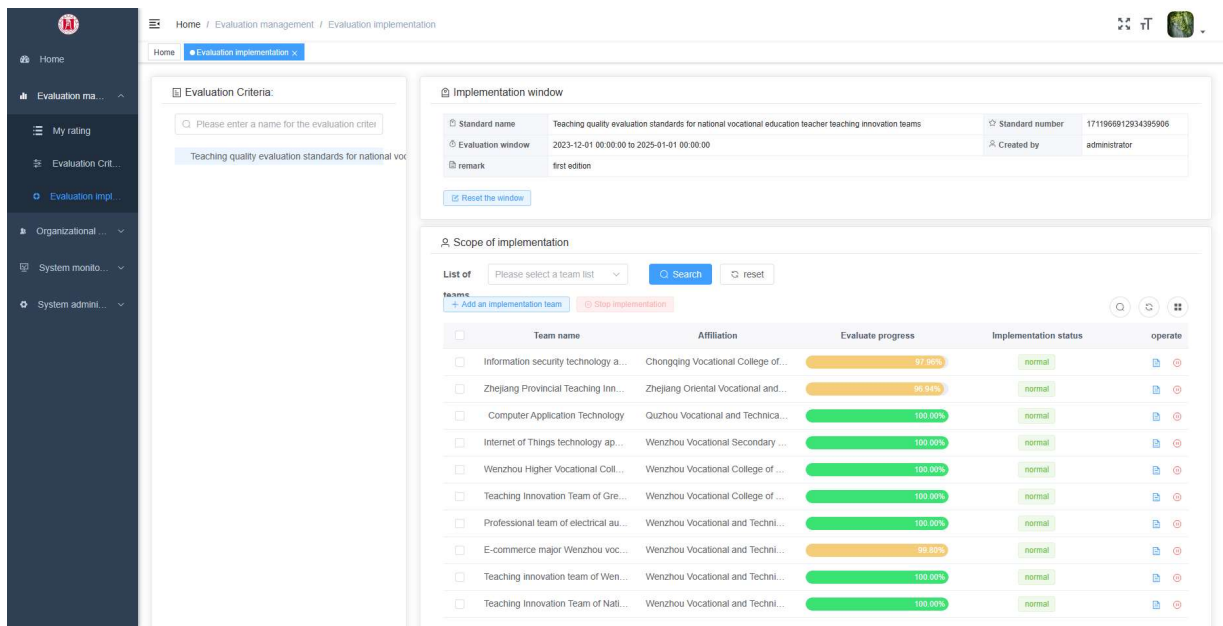


Figure 6. Evaluation Implement

#### (4) Organization and management module

Focus on the organizational level of the teaching team and the evaluation activities. It includes five functions: Team Management, User Management, and Role Management. Together, these functions form the management basis of the system's organizational structure, allowing the system administrators to fully manage the teaching team, user information, and roles. The system management module is the background support part of the maintenance system operation and configuration. It includes four functions: Menu Management, Dictionary Management, Parameter Management, and Log Management. These functions ensure the configurability, stability and maintainability of the system, providing a solid technical support for the daily operation of the system.

The architecture design of the whole teaching quality evaluation management system reflects the characteristics of user center, comprehensive function and simple operation. Through this layered and modular design, the system can not only meet the evaluation needs of different users, but also adapt to the ever-changing educational evaluation environment, providing strong technical support for the teaching innovation team of vocational education.

## 5. Discussion

Some problems were found in the process of designing and realizing the data platform for teaching quality in the evaluation of vocational education, and timely measures were taken to solve them effectively.

#### (1) Data diversity and quality are very important

The key to the success of the platform is in collecting comprehensive and high-quality data. This includes not only students' academic performance and teachers' teaching evaluation, but also covers multiple dimensions of students' background information, the use of teaching resources, industry dynamics and so on. Therefore, a multi-source data integration system is constructed to ensure the real-time update and accuracy of the data. At the same time, the data cleaning process is implemented to eliminate outliers and missing data and improve the data quality.

#### (2) User engagement affects data validity

At the early stage of the platform, the participation of users (including students, teachers and enterprise personnel) was not high, which resulted in incomplete collection of some data and affected the analysis effect. By optimizing user experience, adding interactive elements and clarifying data value communication, user activity is significantly increased.

#### (3) The importance of continuous iteration and user feedback

After the platform went launched, the initial version had some unforeseen problems, and user feedback was indispensable to identifying these problems. A continuous feedback mechanism has been established to regularly collect and analyze user opinions, quickly fix problems, and constantly optimize the platform functions to ensure its long-term effectiveness and adaptability.

#### (4) Privacy protection and ethical considerations

When processing personal data, we must strictly abide by privacy protection laws and balance the relationship between data utilization and protection of personal rights and interests. To this end, measures such as data encryption, anonymity and access management have been implemented to ensure that all operations meet relevant privacy protection standards.

Through these findings, the team members deeply realized that in the design and implementation of the vocational education teaching quality evaluation data platform, it is necessary to comprehensively consider the breadth and depth of data, user participation, privacy protection and the iterative improvement of the platform, in order to build an efficient and responsible teaching quality evaluation data platform.

## 6. Conclusion

This paper realizes the platform of big data technology professional national vocational education teachers teaching innovation team, Chongqing electronic engineering vocational college information security technology application team 10 teaching team teaching quality evaluation, participants including 65 team members, teaching supervision 38 people, enterprise personnel 55 people, 450 students, a total of 608 people. The average deviation of the platform's evaluation results was 14.85%, and the evaluation results were relatively accurate. The evaluation results of this

platform show that the evaluation performance of the platform is relatively accurate, and the evaluation results of the national teacher team, provincial teacher team and municipal teacher team meet the characteristics of the team.

This paper gives the specific design and implementation method of the teaching quality evaluation data platform of the teacher teaching innovation team, which not only reflects the frontier trend of educational informatization, but also is an important measure to improve the teaching quality, promote educational fairness and meet the needs of the rapid development of social economy. Through comprehensive data collection and in-depth analysis, the platform provides valuable information resources for teachers, students, education administrators and even policy makers, which helps to optimize teaching strategies, stimulate teaching innovation, and realize the precise connection between educational goals and social needs.

Later will further improve the system of man-machine interface, rich statistical analysis function, follow up the quality of teaching quality control and evaluation of the latest requirements, provide all kinds of more targeted data products, improve the user experience, pay attention to security considerations, the key data operation certification level, reduce the system risk, ensure the security of the background database.

## Acknowledgments

This work was supported by Teacher Work Department of the Ministry of Education in 2022 (No.ZI2021120106).

## References

- [1] Lu Minghao. Research on teacher performance appraisal based on fuzzy comprehensive evaluation model [J]. Heilongjiang Science, 2024,15 (1): 59-61.
- [2] Li Jia, Feng Xingjie, Liang Zhixing. Index system and model construction of mixed teaching quality influencing factors in colleges and universities based on empirical research [J]. Laboratory Research and Exploration, 2022,41 (12): 224-231.
- [3] Yu Junli. Design and implementation of the classroom teaching quality evaluation system for college teachers [D]. Hunan University, 2014.
- [4] Yan Chaosheng, Zhang Chengjiang, Li Dan. Design and implementation of a Web-based evaluation system for teaching quality [J]. Computer Engineering and Design, 2010 (004): 031.
- [5] Faham E , Rezvanfar A , Mohammadi S H M ,et al.Using system dynamics to develop education for sustainable development in higher education with the emphasis on the sustainability competencies of students[J].2017(8):175-183.
- [6] Xue Shaowen. Research on information teaching quality evaluation system based on intuitive fuzzy hierarchical entropy weight analysis method [J]. Vocational Technology, 2023,22 (5): 57-62.
- [7] Jing Wenli. Exploration and practice of the construction of information Teaching platform in higher vocational colleges -- Take Tianjin Medical College as an example [J]. China Vocational and Technical Education, 2020 (26): 5.
- [8] Sauer mann J , Mengel F ,Ulf Zö litz. Gender Bias in Teaching Evaluations[J].Social Science Electronic Publishing, 2017, 17(2):535-566.
- [9] Ahmad T .Teaching evaluation and student response rate[J]. Psu Research Review, 2018, 2(3):206-211.