Research on Performance Evaluation of Virtual Teaching and Research Section in Universities

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Abstract. The performance of virtual teaching and research section in universities refers to the effect that universities have achieved in the process of virtual teaching and research section construction. In order to scientifically evaluate the performance of the virtual teaching and research section in universities, firstly, based on the performance evaluation theory of virtual teaching and research section in universities, this article started with constructing the system structure of virtual teaching and research section in universities, and explores the indicator system for performance evaluation of virtual teaching and research section in universities; Secondly, a table style was designed to facilitate data collection and indicator statistics; Finally, a comprehensive performance evaluation algorithm for virtual teaching and research section in universities based on Delphi and Fuzzy methods was proposed. The research results of this article can provide certain theoretical and methodological guidance for the education regulatory department to evaluate the performance of the construction of virtual teaching and research section in universities.

Keywords: virtual teaching and research section, performance evaluation, comprehensive evaluation

1 Introduction

The virtual teaching and research section is a new type of grassroots teaching organization in the era of "intelligence +"[1], which has the characteristics of flexible personnel composition, informatization of organizational carrier, interactive teaching and research methods, and diversified teaching and research content. The Department of Higher Education of the Ministry of Education will start the pilot project of virtual teaching and research section in 2020, and strive to build a national higher education virtual teaching and research section information platform through 3 to 5 years of hard work, build a group of virtual teaching and research section with advanced concepts, comprehensive coverage, and complete functions, and forge a batch of high-level teaching teams, cultivate a batch of teaching research and practical results, create a community of teacher teaching development and quality culture, and comprehensively improve teachers' teaching ability[2]. As of June 2023, the Ministry of Education has approved the construction of 657 virtual teaching and research section.

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The construction of virtual teaching and research section in universities is a process of multi-participation and collaborative work. It not only involves different subjects such as the government, enterprises, and universities, but also involves different groups such as managers and teachers internally. In addition, it also involves disciplines, majors, courses, teaching materials, platforms, etc. Zu Qiang (2022) proposed from the perspective of synergy theory that stakeholders concerned with the construction of virtual teaching and research section should pay attention to the independence and integrity of virtual teaching and research section, and strengthen the collaborative implementation and evaluation of virtual teaching and research section [3]. Zeng Jianchao (2020) et al. took the construction of virtual teaching and research section as the research subject, and sorted out the construction of virtual teaching and research section from four aspects: construction origin, construction connotation, function positioning, and construction path [4]. Sang Xinmin (2021) on the basis of summarizing the "Learning Science and Technology" course and teaching and research innovation cases, discussed the theoretical basis and engineering design ideas for deepening the construction of virtual teaching and research section, tried the form and methodology of modeled expression, and proposed in-depth school-enterprise cooperation The "dual-teacher teaching" mode [5]. Zhan Dechen (2022) proposed a virtual teaching and research section construction framework that includes four parts: team building, platform building, mechanism building, and content building [6]. Yin Jianping (2021) took the construction of the "teacher's way" course ideological and political virtual teaching and research section of North University of China as an example, and constructed a "five-in-one" course ideological and political integration of "top-level design, teacher training, course construction, content optimization, evaluation and incentives"[7]. The education model has effectively improved the effectiveness of curriculum ideological and political education, and provided a reference for the ideological and political construction of characteristic courses and the construction of virtual teaching and research section in universities. Yan Xiao (2022) proposed that virtual teaching and research section use Internet technology as a means to transform and upgrade traditional undergraduate teaching and research section through the cloud[8]. Adopt online-based, flexible combination of online and offline, collaborate to achieve interdisciplinary integration and resource sharing, promote more advanced teaching concepts and methods to extend, implement, and guide educational and teaching practices, and help high-quality higher education Developed virtual teaching and research section construction plan.

Previous studies have mainly explored the construction of virtual teaching and research section, but the evaluation of the benefits and performance of virtual teaching and research section construction projects in universities during a certain period of construction has not been resolved. Therefore, this article will be based on the performance evaluation theory of virtual teaching and research section in universities, and based on the system structure and target tasks of virtual teaching and research section in universities, establish a performance evaluation index system for the construction of virtual teaching and research section in universities. Using Delphi and Fuzzy methods, a comprehensive performance evaluation algorithm for virtual teaching and research section in universities will be proposed.

2 Theoretical basis for performance evaluation of virtual teaching and research section in universities

Performance refers to the outcome and impact of behavior, which is achieved or achieved. Performance evaluation is an important component of performance management, which evaluates the results and impacts of behavior. The performance of virtual teaching and research section in universities refers to the results achieved in the construction process of virtual teaching and research section. According to a certain evaluation process, a combination of qualitative and quantitative methods is adopted, based on certain quantitative indicators and a large amount of objective data, to comprehensively measure and evaluate the construction process and effectiveness of virtual teaching and research section, and the evaluation results are applied to the construction of virtual teaching and research section[9]. Effective performance evaluation results of virtual teaching and research section can provide the correct direction for the development of virtual teaching and research section.

The performance evaluation of virtual teaching and research section in universities includes not only evaluating the usability, accessibility, interactivity and responsiveness of teaching and research resources and services in universities using the information platform of virtual teaching and research section in universities, but also evaluating the content construction capabilities of virtual teaching and research section in universities and the government and enterprise Satisfaction of stakeholders such as universities; it also includes evaluating the changes in disciplines, personnel training, teaching staff, education and teaching, and the improvement in efficiency and effectiveness of universities through the construction of virtual teaching and research section[10]. The performance evaluation of virtual teaching and research section in universities must follow certain principles to make the evaluation results scientific and effective, such as scientific principles, system optimization principles, comparability principles, goal-oriented principles, and the combination of quantitative and qualitative principles.

The first step in the performance evaluation of virtual teaching and research section in universities is to clarify the evaluation goals. Only clear evaluation goals can provide the correct direction for the evaluation. The determination of the evaluation subject and evaluation object is a very important aspect of the performance evaluation of a virtual teaching and research section in a university. In general, the evaluation subject includes two types of internal evaluation and external evaluation. The internal evaluation subject refers to the university department itself, and the external evaluation subject is an entrusted third-party organization. For different levels of evaluation objects, such as by function or by project, the object of performance evaluation will change accordingly. The performance evaluation of virtual teaching and research section in universities needs to establish a comprehensive performance evaluation index system. The performance evaluation index system is the core element of the performance evaluation of virtual teaching and research section in universities, including evaluation indicators, index weights, and index scores. Expert consultation method and analytic hierarchy process are common methods in determining the performance evaluation index system. The performance evaluation of the virtual teaching

and research section in universities is not only to evaluate and understand the current status of the construction and development of the virtual teaching and research section in universities, but also to give feedback on the performance of the virtual teaching and research section in universities, so as to improve the construction of the virtual teaching and research section in universities.

3 Construction of performance evaluation index system for virtual teaching and research section in universities

3.1 The system structure of the virtual teaching and research section in universities

In order to facilitate the comprehensive analysis and research of the problems arising in the construction process of virtual teaching and research section in universities, and promote the construction tasks and indicators of virtual teaching and research section in universities to be more scientific, follow the basic principles of system theory, and construct virtual teaching and research section in universities according to the connotation and target tasks of virtual teaching and research section in universities. The system structure of the teaching and research section is shown in Figure 1:

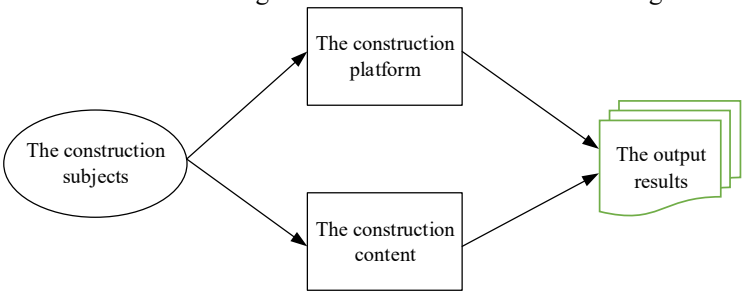

Fig. 1. The system structure diagram of the construction of virtual teaching and research section in universities

Among them:

The construction subjects mainly include the construction committee, core teachers, and cooperative teachers.

The construction platform is mainly a virtual teaching and research section platform integrating teaching, scientific research, resources, and management relying on modern information technology.

The construction content mainly includes teaching and research activities, collaborative teaching and research, and joint construction of teaching resources.

The output results mainly include demonstration virtual teaching and research section, first-class courses, famous teaching teachers, first-class teaching materials, and teaching achievement awards.

3.2 The performance evaluation index system of virtual teaching and research section in universities

According to the functions and evaluation information requirements of each component in the system structure of the virtual teaching and research section in universities, the performance evaluation index system of the virtual teaching and research section in universities is designed by using the analytic hierarchy process, as shown in Figure 2.

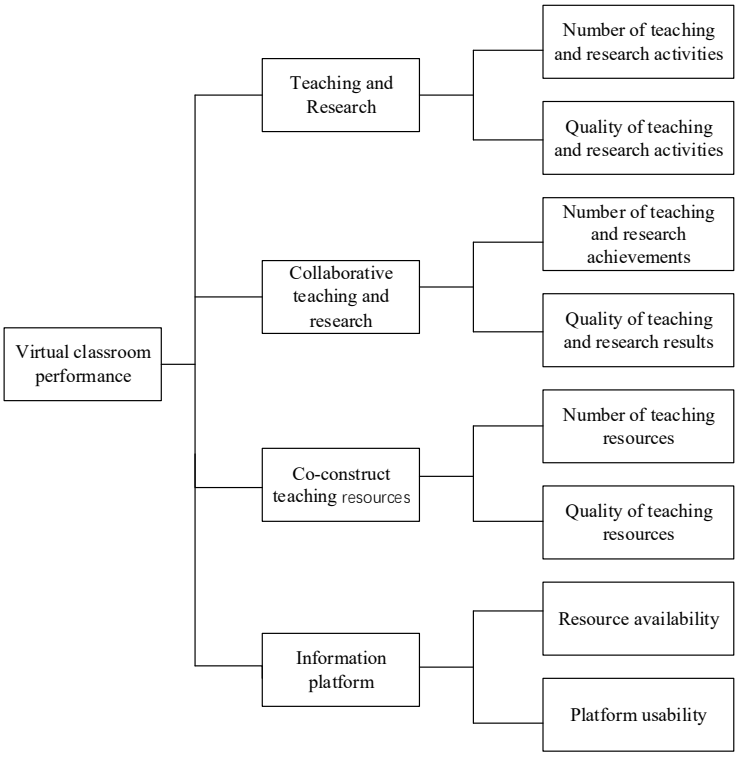

Fig. 2. The performance evaluation index system diagram of virtual teaching and research section in universities

The meaning of each indicator is as follows:

(1) The degree of teaching and research activities reflects the degree of teaching and research activities

(2) The degree of collaborative teaching and research reflects the degree of teaching and academic research

(3) The degree of co-construction of teaching resources reflects the degree of co-construction of teaching resources

(4) The degree of support of the information platform reflects the support degree of the constructed virtual teaching and research section platform to the work of the platform users.

3.3 Design of data collection form for performance evaluation indicators of virtual teaching and research section in universities

In order to facilitate data collection and statistical calculation of index feature values, the following related table styles are designed.

Table 1. The status of teaching and research activities

Collaborative teaching and research form	Number of teaching and research activities	Quality of teaching and research activities (number of people with different satisfaction)		
	Number of activities	"Satisfied" number	"Basically Satisfied" number	"Dissatisfied" number
Teaching Salon				
Teaching Lecture				
Teaching Academic Research Forum				
Special training				

The main purpose of Table 1 is to record the quantity and quality of activities carried out by various types of faculty activities. The forms of collaborative teaching and research include teaching salons, teaching lectures, teaching academic research forums, and special trainings. The quality of teaching and research activities is mainly determined by the satisfaction of participants. To describe the degree of satisfaction, the satisfaction levels "satisfied", "basically satisfied" and "dissatisfied" correspond to three levels of high, medium and low quality of teaching and research activities respectively.

Table 2. Collaborative teaching and research situation table

Types of teaching and research projects	Quality of teaching and research (Number of teaching and research achievements at different levels)		
	Number of school-level achievements	The number of provincial achievements	Number of country-level results
Team building			
Professional construction			
Curriculum construction			
Teaching practice			

The main purpose of Table 2 is to record the quantity and quality of various teaching and research projects. The types of teaching and research projects include team building, professional construction, curriculum construction, and teaching practice. The quality of teaching and research projects is mainly measured by the level of teaching and research results, from low to high There are three levels: school level, provincial level, and national level.

Table 3. The situation table of co-constructed teaching resources

Form of teaching resources	Types of teaching resources	Teaching resource quality level
Subject Construction Resources	Discipline construction plan Teaching Academic Research Experience	
Professional Construction Resources	Professional talent training plan First-class professional construction experience	
Curriculum Construction Resources	Course Outline Lesson plan Courseware Virtual simulation experiment Exercise library	

The main purpose of Table 3 is to record the construction quality of various types of teaching resources. Discipline construction resources include discipline construction plans and teaching and academic research experience, and specialty construction resources include professional talent training plans and first-class professional construction experience. Course construction resources include course outlines, teaching plans, teaching courseware, virtual simulation experiments, exercise banks, etc. The quality of co-constructed teaching resources is divided into three levels from low to high: first class, second class, and third class.

Table 4. Information platform support table of virtual teaching and research section

Platform support indicators	performance level
Resource availability	
Platform usability	

The availability of resources in Table 4 mainly reflects the content construction capacity of virtual teaching and research section in universities, with three levels of availability performance from low to high: first class, second class, and third class. Platform usability refers to the ability of virtual teaching and research section information platform software products to be understood, learned, used, and attracted to virtual teaching and research section users under specified conditions, with performance levels ranging from low to high, including first class, second class, and third class.

4 Evaluation Algorithm for Performance Evaluation of Virtual Teaching and Research Section in Universities

The Delphi method, also known as the old method, was first used in the field of decision-making by the Rand Corporation of the United States in 1964. This method is concise and intuitive, and is often used in practice to determine the target weight. In

this paper, this method is mainly used to determine the weights of teaching and research activities, collaborative teaching and research, co-construction teaching resources, and information platform support, and use this method to determine the quality level of teaching resources and the performance level of platform support indicators. For specific methods, see Literature [11].

In many practical problems, people's understanding of some evaluation objects is not clear enough, and they can only be described in some vague language, and it is impossible to give a clear mathematical expression. The effective method for dealing with these problems is the Fuzzy method. In this paper, we use fuzzy language to describe the satisfaction of teaching and research activities, and use the method of fuzzy comprehensive evaluation to evaluate.

According to the above analysis and discussion, the algorithm steps of the Delphi-Fuzzy method can be summarized into the following steps:

(1) Collect data according to the format of Table 1, Table 2, Table 3 and Table 4. Among them, using Delphi method and Fuzzy method, experts determine the quality level of various types of teaching resources according to the completion of evaluation indicators of various types of teaching resources, Determine the performance level of the information platform of the virtual teaching and research section according to the evaluation index of the information platform.

(2) Calculate the degree of teaching and research activities, the degree of collaborative teaching and research, the degree of co-construction of teaching resources, and the degree of information platform support.

$$\begin{aligned}&\text{Degree of teaching and research activities} = \\ &\sum_{\text{Teaching and research form}} \sum_{\text{Teaching and research activities}} (\text{"Satisfied" number} \times \text{"Satisfied" score} + \text{"Basically Satisfied" number} \times \text{"Basically Satisfied" score} + \\ &\text{"Dissatisfied" number} \times \text{"Dissatisfied" score}) \quad (1)\end{aligned}$$

$$\begin{aligned}&\text{Collaborative teaching and research degree} \\ &= \sum_{\text{Types of teaching and research projects}} (\text{School level quantity} \times \text{School level score} \\ &+ \text{Provincial level quantity} \times \text{Provincial level score} \\ &+ \text{National level quantity} \times \text{National level score}) \quad (2)\end{aligned}$$

$$\begin{aligned}&\text{Co} - \text{construct teaching resources degree} \\ &= \sum_{\text{Types of teaching resources}} \text{Scores of various teaching resources} \quad (3)\end{aligned}$$

$$\begin{aligned}&\text{Information platform support degree} \\ &= \sum_{\text{Platform support indicators}} \text{Scores of various performance levels} \quad (4)\end{aligned}$$

(3) Use the Delphi method to determine the weights $w1$, $w2$, $w3$, and $w4$ of teaching and research activities, collaborative teaching and research, co-constructed teaching resources, and information platform support, where $w1 + w2 + w3 + w4 = 1$.

(4) Calculate the result of the comprehensive evaluation, the formula is as follows:

$$\text{Virtual Teaching and Research Room Performance} = w1 \times \text{Tteaching and research activities degree} + w2 \times \text{Collaborative teaching and research degree} + w3 \times \text{Co} - \text{construction resource degree} + w4 \times \text{information platform support degree} \quad (5)$$

5 Conclusions

In order to make a valuable comprehensive judgment on the benefits and performance of the virtual teaching and research section construction project in universities during a certain construction period, this paper discusses the performance evaluation indicators of virtual teaching and research section in universities based on the performance evaluation theory of virtual teaching and research section in universities, starting from the construction of the system structure of virtual teaching and research section in universities Based on the Delphi-Fuzzy method, using a systematic analysis method that combines qualitative and quantitative, expert evaluation and scientific calculation to complement each other, a performance evaluation algorithm for virtual teaching and research departments in universities is designed. The index system and evaluation algorithm for the performance evaluation of virtual teaching and research section in universities designed in this paper are systematic, comprehensive, scientific, reliable, simple and practical, and provide certain theoretical guidance for the education authorities to evaluate the construction performance of virtual teaching and research section in universities. It is of great significance to implement the effect of teaching organization management and ultimately improve the high-quality development of universities.

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