

# Dynamic Evaluation Model of Applied Undergraduate Teaching Quality based on Big Data Analysis

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**Abstract:** In order to better grasp the actual effect of current application-oriented undergraduate teaching in our country, a dynamic evaluation model of application-oriented undergraduate teaching quality is proposed based on the principle of big data analysis. Firstly, the dynamic information in the teaching process is collected based on the principle of feature collection, and the information collection steps are optimized. According to the collected information, the teaching quality evaluation grades are divided, thus realizing the research goal of quality evaluation of teaching information of different grades. Finally, the experiment proves that the application-oriented undergraduate teaching quality dynamic evaluation model based on big data analysis has higher evaluation accuracy than the traditional model.

**Keywords:** Big data; Applied undergraduate course; Teaching quality; Dynamic evaluation

## 1. Introduction

With the continuous expansion of the scale of education, quality issues naturally become the focus of attention of all countries. Due to special historical reasons, application-oriented undergraduate education started late in China, but developed rapidly. Especially in the past ten years, with the large expansion of undergraduate enrollment, applied undergraduate education has also grown rapidly. Under this background of large-scale and high-speed development, the quality problem of application-oriented undergraduate education has also emerged [1]. At the same time, the requirements of the new era for the cultivation of innovative talents and the current practical contradiction of insufficient innovative ability of application-oriented undergraduate, especially doctoral students, also make people pay special attention to the quality problem of application-oriented undergraduate. With the expansion of the scale of applied undergraduate education year by year, how to ensure the quality of applied undergraduate education has become the most concerned topic of applied undergraduate educators, and has aroused great attention from the education authorities [2]. Therefore, it is of great significance to establish an evaluation and guarantee system for the quality of applied undergraduate education in the new era so that it can meet the needs of society and its own development. On the basis of systematic analysis of relevant research activities and research results in China, this paper analyzes the concepts and connotations of "quality", "education quality" and "applied undergraduate education quality". Through the analysis of the main factors affecting quality, and draw-

ing lessons from various evaluation practices on applied undergraduate education quality, it attempts to establish a classified evaluation index system of applied undergraduate education quality based on universities.

## 2. Dynamic Evaluation Model of Applied Undergraduate Teaching Quality

### 2.1. Optimization of data mining process for teaching quality

Quantitative evaluation of teaching quality is a necessary prerequisite for effective data mining of teaching quality evaluation. According to the general steps of data mining, the following explains the process of applying data mining in teaching quality evaluation [3]. Generally, according to the basic links of data mining, it can be divided into three stages: data preparation, data mining and result analysis. First, data sources are needed before data mining. The data in the teaching database in the school educational administration system are cleaned and sorted to form source data, and then data mining is carried out. The teaching quality analysis and evaluation system uses the data conversion function of the computer to directly open the information source database for data collection. The content of data collection includes teaching quality information data and teacher file data [4]. The main goal of data preprocessing is to eliminate noise or inconsistent data and avoid different names or different data with the same name of the same data caused by numerous data sources, which will make the data used for data mining more tidy and clear and avoid data mining deviation or even errors caused by data source problems. After col-

lecting the data, the data will be transformed into a data model that can be recognized by the mining system.

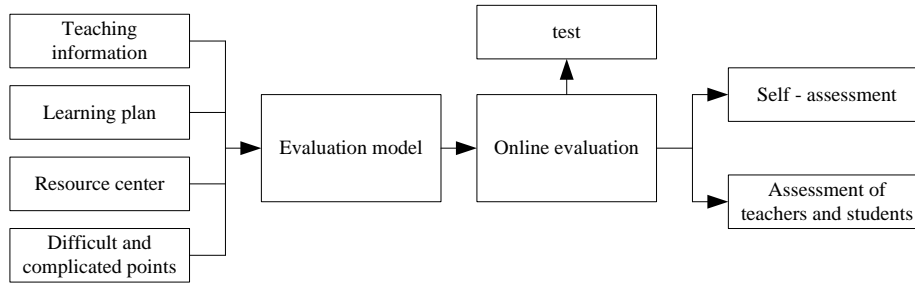


Figure 1. Principle of data mining for teaching quality

Because there are many qualitative components and few quantitative components involved in teaching quality assessment, only qualitative standards can be given on the whole, and the standards are flexible. In addition, the evaluators have bias in grasping the standards and subjective understanding, which all add difficulty to the quantitative analysis of teaching quality assessment. The analytic hierarchy process is a combination of qualitative and quantitative analysis, which expresses people's subjective judgment in quantitative form and carries out scientific treatment. It better conforms to the characteristics of teaching quality evaluation problems and more accurately reflects the main problems it faces [5]. First of all, the index system should be decomposed into different levels, the subordination relation between the general goal and each criterion and index should be determined from top to bottom, multi-level indexes should be estab-

lished, and the evaluation system should be continuously improved with the development of teaching. The basic steps of analytic hierarchy process are as follows: first, establish a hierarchical structure model [6]. The relevant factors are decomposed into several levels from top to bottom according to their attributes. Each factor of the same level is subordinate to the factor of the previous level, or has influence on the factor of the upper level, while controlling the factor of the next level or being influenced by the factor of the lower level. The second step is to construct a pair of comparison matrices. Starting from the second layer of the hierarchical structure model, a pair comparison matrix is constructed by using a pair comparison method and a pair comparison scale until the lowest layer; (3) calculating the weight vector of each pair of comparison matrices; the fourth step is consistency check.

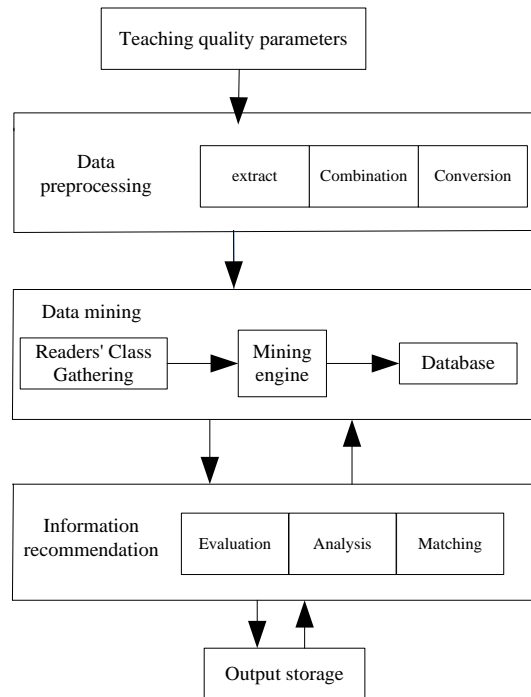


Figure 2. Data mining steps for teaching quality

According to the above steps to complete the collection of teaching data, and for the quantitative evaluation index of teaching quality based on the analytic hierarchy process and fuzzy comprehensive evaluation method, the teaching quality evaluation data set including the teaching quality evaluation data and the quantitative evaluation index obtained by the analytic hierarchy process is deeply mined [7]. The quantitative index system is discretized into four intervals, which respectively correspond to four subjective evaluation indexes of "unqualified", "average", "good" and "excellent" teaching quality. Through the discrimination of decision tree, the teacher's teaching quality evaluation data input into the teaching quality evaluation system is classified into one of four subjective evaluation index categories, thus effectively evaluating the teaching quality.

**2.2. Standard of teaching quality assessment grade**

In a sense, the evaluation system of applied undergraduate colleges is the standard to be reached to further improve the evaluation objectives. Therefore, the principles of the evaluation system of applied undergraduate colleges need to be established. In the operation of the evaluation system, the following principles must be determined.

First. Objectivity principle: The basic requirement of objectivity is seeking truth from facts, the evaluation index system is scientific and reasonable, and the evaluation objects are treated equally [8].

Second. Principle of comprehensiveness: teaching evaluation should prevent overemphasis on one aspect and lead teaching work to one-sidedness or even backfire, prevent one tendency from masking another, and comprehensively collect information on various aspects of the teaching process and environment. Three basic elements

of teaching activities, namely, students and intermediate media, should be comprehensively analyzed.

Third. Feasibility principle: The feasibility principle requires the teaching evaluation scheme and evaluation index system to be comparable, measurable, simple and convenient. The evaluation should consider not only the basic requirements of national education, but also the current situation and development trend of the school and the actual situation.

Fourth. Incentive principle. Teaching evaluation is not simply a description of teaching situation. Instead, it measures and judges the teaching work against the objectives and advanced standards, so as to achieve the goals of summarizing experience, affirming achievements, diagnosing problems, tapping potentials, clarifying directions, promoting work and continuously improving the quality of education [9]. Therefore, it is necessary to have matching management and reward policies, and combine the evaluation results of different degrees with the personal interests in a certain period of time to encourage excellence in teaching.

Under the condition of complying with the above principles, standardize the quality evaluation method, specifically including.

First. Colleague evaluation: The academic affairs office and each college shall determine the evaluation courses respectively, and the expert group shall conduct the inspection lectures.

Second. Student evaluation: students evaluate the quality of classroom teaching for their own teachers in this semester each semester. The evaluation of teachers' classroom teaching quality in each semester is usually arranged before the final exam.

Third. Expert evaluation: The specific evaluation index system of leadership evaluation and student evaluation is shown in the table:

**Table 1. Expert evaluation index parameters**

Primary indicator	Secondary index	Weight	Rating scale			
			Excellent 1.0	Good 0.8	Qualified 0.6	Unqualified 0.4
Get ready	Preparation before class	0.40	A	B	C	D
Process	Teaching plan quality	0.60	A	B	C	D
	Teaching attitude	0.80	A	B	C	D
	Teaching content	0.10	A	B	C	D
	Teaching organization	0.10	A	B	C	D
	Teaching media	0.10	A	B	C	D
	Teaching method	0.12	A	B	C	D
	Innovation consciousness	0.14	A	B	C	D
	Combined with practice	0.16	A	B	C	D
Effect	Conceptual argument	0.18	A	B	C	D
	Student performance	0.20	A	B	C	D
	Classroom response	0.20	A	B	C	D
End	Degree of compliance	0.20	A	B	C	D
	Assign homework	0.5	A	B	C	D
	Summary after class	0.5	A	B	C	D

**Table 2. Evaluation index parameters of colleagues**

Primary	Secondary index	Weight	Rating scale
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indicator			Excellent 1.0	Good 0.8	Qualified0.6	Unqualified0.4
Teaching attitude	The lecture was enthusiastic and energetic.	0.50	A	B	C	D
Teaching content	Be dignified in appearance, generous in manner, and be a model for others.	0.50	A	B	C	D
	Skilled content	0.40	A	B	C	D
	Clear instruction	0.60	A	B	C	D
	Content expansion	0.40	A	B	C	D
Teaching method	Response and contact statement	0.60	A	B	C	D
	Cultivating students' ability of independent thinking and innovation	0.80	A	B	C	D
	In-depth and simple, inspire students' thinking	0.80	A	B	C	D
Teaching effect	Promote students' thirst for knowledge and classroom atmosphere	0.10	A	B	C	D
	The blackboard writing is neat.	0.5	A	B	C	D
	Contagious	0.5	A	B	C	D

Table 3. Parameters of student evaluation indicators

Primary indicator	Secondary index	weight	Rating scale			
			Excellent 1.0	Good 0.8	Qualified 0.6	Unqualified 0.4
Teaching attitude	Observe time and discipline and be a model for others.	0.50	A	B	C	D
	Strictly require respect for opinions					
Teaching content	Clear point of view, clear concept	0.50	A	B	C	D
	It is appropriate to give examples in connection with reality.	0.40	A	B	C	D
	Focus, Clear Organization	0.60	A	B	C	D
Teaching method	Teach students according to their aptitude and inspire teaching	0.80	A	B	C	D
	The language is vivid, deep and simple	0.80	A	B	C	D
	There are various means, and wrenches are orderly.	0.10	A	B	C	D
Teaching effect	Training of Knowledge Mastery Ability	0.5	A	B	C	D
	Ideas include arousing interest	0.5	A	B	C	D

The evaluation index system divides the actual evaluation grades of teaching quality in application-oriented undergraduate universities by integrating the evaluation indexes of experts, teachers and students, so as to accurately evaluate the teaching quality according to the grade division.

**2.3. Realization of dynamic evaluation of teaching quality**

Neural network is used to identify teaching quality evaluation parameters. Here, one evaluation index is taken as the input of the neural network system and the evaluation target, namely, Teaching effect, is taken as the output of the system [10]. The network is a one-way propagation multi-layer forward network. Apart from the input and output nodes, the network has one or more hidden layer nodes, and the layer nodes do not have any disaster. Input signals pass through each hidden layer node from the input layer node, and then pass to the output node. The back propagation algorithm is used to identify the evaluation system. Its basic idea is the least square method and gradient search technology, so as to minimize the unqualified mean square error between the actual output value and the expected output value of the network. The learning process of the network is the process of correcting the

weighting coefficient while the unqualified error propagates backward, so it can be used to identify the teaching quality evaluation system. Let the input layer of the network is  $t = \{t_1, t_2, \dots, t_n\}$ , where  $t$  is each evaluation index of the teaching quality evaluation system. here  $n=7$ , the hidden layer of the network is:

$$v_{ij} = \int a(\overline{t_n}) \tag{1}$$

$$fir\xi = \sum_n^{j=1} v_{ij}t_n \tag{2}$$

Where,  $a$  is the weight coefficient of teaching quality grade,  $a(x)$  is the excitation function, and  $a(y)$  is the transfer function, which can be obtained according to sigmoid function algorithm:

$$a(x) = \prod \frac{1 - fir\xi}{1 + fir\xi} \tag{3}$$

$$a(y) = \bigcap \frac{\sqrt{|1 - fir\xi|}^{n-1}}{2(fir\xi + 1)} \tag{4}$$

The BP algorithm can minimize the performance index. in order to ensure the global stability of the system, the actual output value  $z$  of the identified object teaching quality evaluation system is taken as a feedback signal and compared with the output  $z'$  of the neural network

identifier, so that  $z \& lt; z'$  is one. If the requirement is not met, the weight coefficient is continuously adjusted to meet the expected requirement. According to the back propagation calculation formula, the following weight system teaching quality evaluation algorithm can be obtained:

$$\Delta W = \bigcup \frac{1}{2 \| [a(x) - a(y)] * \| [a(x) + a(y)] \quad (5)$$

According to the above algorithm, the dynamic evaluation index of teaching quality in application-oriented undergraduate colleges is comprehensively evaluated. First, the evaluation index must be determined. Through extensive investigations, it is found that most colleges and universities adopt a quantitative teaching quality evaluation system, which usually evaluates its teaching content, teaching method, teaching attitude, teaching effect, teaching ability, etc. The first-level index and second-level index evaluation models for teaching quality evaluation adopted in this evaluation model are given as follows.

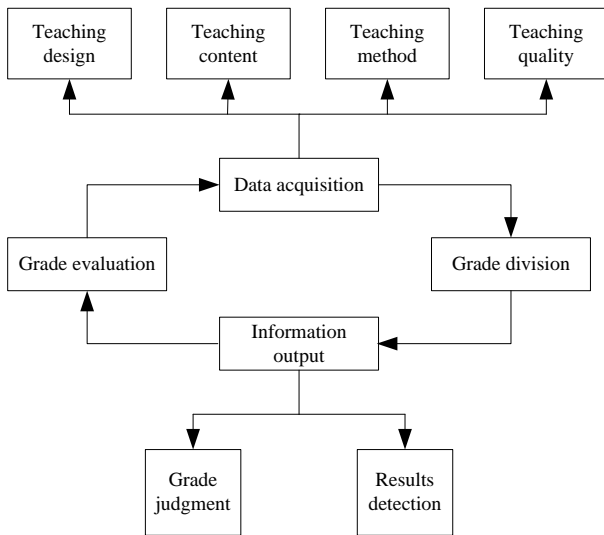


Figure 3. Dynamic evaluation model of teaching quality

According to the above steps, the real-time collection and evaluation of the teaching quality of application-oriented undergraduate universities can be effectively completed, thus achieving the research goal of accurately evaluating and judging massive data.

### 3. Analysis of Experimental Results

In order to verify the validity of the dynamic evaluation model of applied undergraduate teaching quality based on big data analysis, a simulation experiment was designed. A 6-month follow-up survey was conducted on 1,500 students of different grades and majors randomly selected from an application undergraduate university to master the overall learning situation of students, Teach-

ing effect and other relevant information. After the same research parameters are fixed, the traditional method and the method in this paper are used to evaluate respectively to verify the accuracy of the evaluation results. In order to ensure the effectiveness of the evaluation results, the actual learning situation and knowledge mastery effect of 1500 students were comprehensively evaluated and calculated and plotted as a comparison reference. The specific experimental results are shown in the following figure.

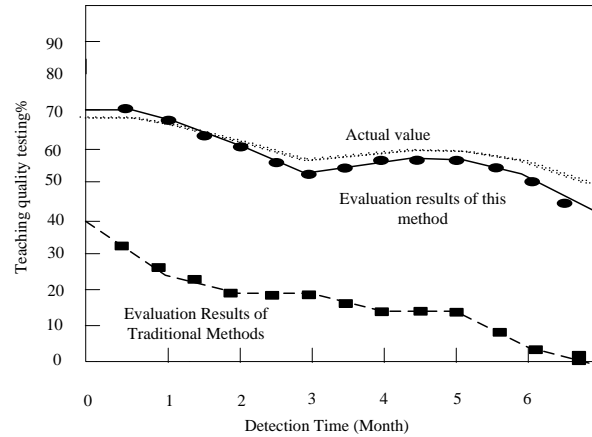


Figure 4. Comparison test results

It is not difficult to observe the above test results. Compared with the test results of the traditional quality evaluation model, the test value of the teaching quality dynamic evaluation model based on big data analysis proposed in this paper is closer to the actual value curve of the researcher's teaching quality evaluation result. This proves that the teaching quality dynamic evaluation model based on big data analysis proposed in this paper can accurately and effectively test the teaching quality of application-oriented undergraduate courses, and fully meet the research requirements.

### 4. Concluding Remarks

The key to the cultivation of talents in schools lies in the quality of teaching, which is also the basis for the survival of schools. Therefore, for the construction and development of applied undergraduate colleges, ensuring and improving the quality of teaching is always the eternal theme. Especially at present, the scale of higher education is continuously expanding, and the teaching quality of higher institutions has become the focus of people's discussion and has received unprecedented attention. Classroom teaching, as the main mode of talent cultivation in colleges and universities, its quality and effect will directly have an important impact on the quality of talent cultivation in colleges and universities. The objective and fair evaluation of classroom teaching can not

only improve classroom Teaching effect and enhance professional development level, but also effectively enhance students' learning enthusiasm and initiative, enabling students to actively participate in it, which has positive effects on classroom teaching such as guidance, improvement and appraisal, and is an important means to improve classroom teaching level.

## References

- [1] Wu Xiewen, He Zongxiang, Cao Yawen. Application of multi-objective group decision-making in undergraduate teaching quality assessment-taking jiangsu province universities in 2013 as an example. *Education and Teaching Forum*. 2018, (1), 47-50.
- [2] Tang Yingmei, Wu Yuhong, Shen Qinyuan. How to establish a reasonable evaluation system of teaching quality-taking nanjing agricultural university as an example. *Journal of Suzhou Vocational University*. 2018, 29(01), 81-83.
- [3] Tian Xinghong, Zhang Yonghua, Xiao Qiongying, et al. Analysis on the structural characteristics and connotation of undergraduate teaching quality assurance system in local universities of science and technology-taking changsha university of science and technology's undergraduate teaching quality assurance system as the main sample. *Innovation and Entrepreneurship Education*. 2017, 8(1), 129-133.
- [4] Li Quanfang, Mu Wenchao. Improving english teaching quality with model innovation-comments on "research on the development and innovation of english teaching model in modern vision". *Higher Education Development And Evaluation*. 2017, 35(1), 140.
- [5] Wang Ruomei. Dynamic evaluation and analysis of reading and writing discourse resources from the perspective of appraisal theory-taking college english corpus as an example. *Journal of Yancheng Institute of Technology (Social Science Edition)*. 2018, 24(1), 12-16.
- [6] Anonymous. Enlightenment of american college curriculum evaluation system on foreign language teaching in china-taking the college of education of concordia university as an example. *Xuezhou*. 2018, 377(29), 17-18.
- [7] Lan Kui. Research on practical education mechanism of ideological and political education in colleges and universities based on "Acquired Sense"-taking "2+1" practical teaching reform of ideological and political theory course as an example. *Education Guide*. 2017, 623(12), 78-82.
- [8] Li Mingxi, Zhong Song, Li Qiong, et al. Exploration and practice of curriculum teaching quality evaluation-taking hubei institute of technology as an example. *Journal of Hubei Institute of Technology (Humanities and Social Sciences Edition)*. 2018, 35(2), 145-146.
- [9] Dai Jinlin. Construction and improvement of teaching quality evaluation system in colleges and universities from the perspective of audit evaluation. *Computer Knowledge and Technology*. 2018, 14(3Z), 92-93.
- [10] Pan Chunhua. Application and implementation of data mining tools in college classroom teaching quality evaluation system-taking qinghai university for nationalities as an example. *Journal of Yantai Vocational College*. 2017, 23(1), 77-81.