

## Quality evaluation system of engineering cost education curriculum based on data clustering

Kong Liang<sup>1</sup>, Cai Xiao-qing<sup>2</sup>, Lu Hui<sup>3,\*</sup>

<sup>1</sup>School of building management, Chongqing Metropolitan College of Science and Technology, Chongqing 402167, China, 980201300042@cqjtu.edu.cn

<sup>2</sup>School of building management, Chongqing Metropolitan College of Science and Technology, Chongqing 402167, China, gs60170@student.upm.edu.my

<sup>3</sup>College of Computer Science, Inner Mongolia University, Hohhot, China 010012, luhui@imu.edu.cn

### Abstract

Aiming at the problems of poor evaluation effect and long system response time in the existing project cost course quality evaluation system, a project cost education course quality evaluation system based on data clustering is designed. The data acquisition module of infrastructure layer is used to collect the quality evaluation data of engineering cost education course, and the collected data is transmitted to the upper computer by can communication module. The processor control module in the upper computer transmits the data to the course quality evaluation module, and the processor control module selects 32-bit fixed-point chip TMS320F2812; After receiving the data, the course quality evaluation module uses the fuzzy matter-element proximity clustering evaluation method in data mining to evaluate the quality of engineering cost education courses. The evaluation results are transmitted to the application layer for users to use, and the evaluation results are displayed to users through the display interface of the display layer to complete the system design. The experimental results show that the proposed system can complete the quality evaluation of engineering cost education course, the response time of system evaluation is controlled within 400ms, and the response efficiency of the system is improved.

**Keywords:** Data clustering, Project cost, Educational courses, Quality, Evaluation system, Infrastructure layer.

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\* Corresponding author. Email: luhui@imu.edu.cn

### 1. Introduction

In recent years, the enrollment scale of colleges and universities has continued to expand, with an annual growth rate of about two percentage points. With the increase of enrollment scale, the quality of students is bound to decline. The growth of teaching staff and teaching facilities in colleges and universities is slow, and the insufficient teaching resources will inevitably affect the quality of education. National education departments at all levels continue to adhere to the Scientific Outlook on Development [1] and carry out in-depth education and teaching reform. In particular, it should continuously increase investment in college education, strengthen the construction of college teachers, and pay attention to the

evaluation of college teaching quality [2]. Engineering cost specialty is one of the new hot specialties added by the Ministry of Education according to the needs of national economic and social development. It is an emerging discipline developed from the specialty of Construction Engineering Management based on economics, management and civil engineering. At present, almost all projects require the whole process budget from commencement to completion, including commencement budget, project progress allocation, project completion settlement, etc. Whether the owner or the construction unit, or the third-party cost consulting organization, they must have their own core budget personnel. Therefore, there is a great demand for project cost professionals and broad development opportunities.

Objectives of teaching quality evaluation: for the country, it make macro-control for the teaching of higher

education through evaluation, master the school running level and quality of colleges and universities, use the evaluation index system to point out the direction of colleges and universities in the future, and effectively improve the school running level and quality of higher education. For colleges and universities, corresponding rectification measures are formulated through the evaluation results [3], so as to promote the construction and improvement of colleges and universities and raise the level of education and teaching to a higher level. Evaluation is only a means. The real purpose is to "promote construction with evaluation, promote reform with evaluation, combine evaluation with construction, and focus on construction". To strengthen the teaching work in colleges and universities, it should not only change the phenomenon of "emphasizing scientific research over teaching" in concept and policy guidance, fully understand the leading role of teachers in the teaching process, and objectively understand the irreplaceable position and role of teaching in colleges and universities, but also explore and gradually improve the scientific evaluation method of teaching quality, reasonably quantify the teaching performance and teaching results [4], and link the evaluation results with the pursuit of teachers, so as to fundamentally change the long-standing situation of "automation of scientific research operation and push of educational work" in colleges and universities, and truly implement the teaching work as the central work of colleges and universities into the actions of teachers. The current teaching quality evaluation mostly adopts the method of student evaluation. Usually, the educational administration department publishes the teacher's teaching quality evaluation form on the Internet at the mid-term or end of the period, scores the teacher according to the evaluation items in the evaluation form, and determines the teacher's teaching quality evaluation grade according to the evaluation results after statistics by the educational administration department [5]. This evaluation method can only obtain simple evaluation results, can not analyze the evaluation data, can not give full play to the guiding role of teaching evaluation in teaching, and does not make full use of the existing data.

Data mining technology has been successfully applied in retail, finance, telecommunications, scientific research and other fields. A large number of researchers obtain the information of teachers, and students and their interaction information through the network online education platform, obtain relevant information through data mining technology, and then put forward suggestions to teachers, use more appropriate teaching methods [6], and constantly improve the teaching level and quality. However, this is only limited to network teaching, but data mining technology is rarely used in classroom teaching. Data clustering is an important technology in data mining technology. Applying data clustering technology to the quality evaluation of engineering cost education curriculum can effectively improve the quality evaluation level of engineering cost education curriculum [7], and provide a basis for promoting the curriculum development of engineering cost specialty. Data clustering technology has

just appeared in recent years, has been widely used in practical fields, and has produced good results.

Classroom teaching quality is an important part of college teaching activities and the guarantee for colleges and universities to cultivate high-quality talents. In 2007, the Ministry of Education put forward several opinions on further deepening undergraduate teaching reform and comprehensively improving teaching quality, and took comprehensively improving teaching quality as an important content of the work of colleges and universities. In 2019, the on-site meeting to promote the high-quality development of national vocational education will be held in Shenzhen Vocational and Technical college, which will take improving the quality of education and teaching as an important content of university construction. The subjects involved in classroom teaching quality are students and teachers. Teachers' teaching level and students' learning ability are related to classroom teaching quality [8], in which the application of teachers' professional knowledge, classroom organization and teaching methods directly affects students' learning effect. The formulation of effective classroom teaching quality evaluation criteria [9] not only contributes to teachers' self-awareness, but also provides a reliable basis for the construction of college teachers.

There are many articles on improving the quality of classroom teaching at home and abroad. DeMara et al. applied Bloom's learning classification method to hierarchical evaluation [10], and realized the evaluation of classroom teaching quality through hierarchical method; Goumairi et al. applied servqual model to the evaluation of higher education service quality in Morocco [11], selected public engineering schools as the research object, and achieved very high application effect. Wang et al. constructed the teaching quality evaluation system of flipped classroom [12] to realize the effective teaching evaluation of learning; Du et al. studied the teaching quality evaluation of Ideological and political course based on students' satisfaction [13], evaluated the teaching quality of Ideological and Political course through students' satisfaction, and verified the effectiveness of teaching quality evaluation of Ideological and Political course through experiments. Although these methods can effectively realize the evaluation of teaching quality, few parameters are considered in the design of system evaluation, which affects the effect of final teaching quality evaluation.

The main technical route of this paper is as follows:

- (1) Using the data acquisition module of infrastructure layer to collect the quality evaluation data of engineering cost education course;
- (2) The collected data is transmitted to the upper computer by the can communication module, the processor control module in the upper computer transmits the data to the course quality evaluation module, and the processor control module selects the 32-bit fixed-point chip TMS320F2812;
- (3) After receiving the data, the course quality evaluation module uses the fuzzy matter-element proximity clustering

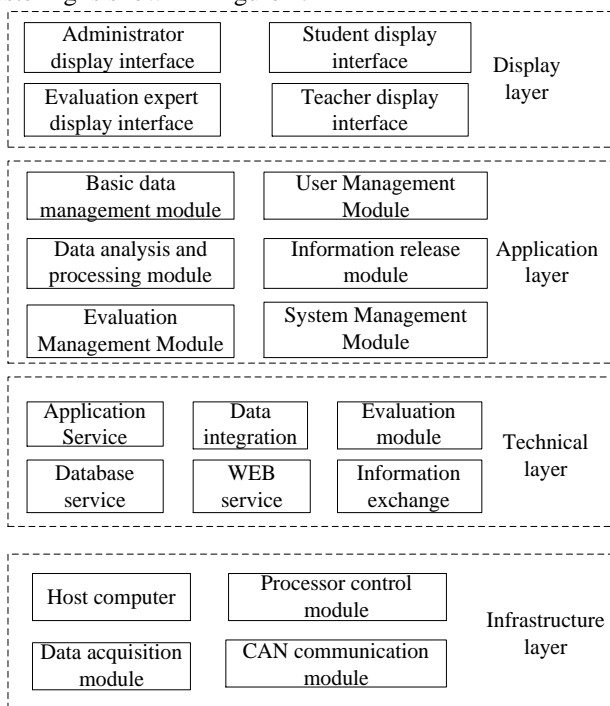
evaluation method in data mining to evaluate the quality of engineering cost education courses. The evaluation results are transmitted to the application layer for users to use, and the evaluation results are displayed to users through the display interface of the display layer to complete the system design.

- (4) Experimental analysis.
- (5) Conclusion

## 2. Design of the quality evaluation system for engineering cost education curriculum

### 2.1. The overall structure of the system

The overall structure of the quality evaluation system for engineering cost education curriculum based on data clustering is shown in Figure 1.



**Figure 1.** The overall structure of the system

It can be clearly seen from the overall structure diagram of the system that the quality evaluation system of engineering cost education curriculum includes infrastructure layer, technology layer, application layer and display layer. The application layer of the system includes basic data management module, user management module, data analysis and processing module, information release module, evaluation management module and system management module. The system uses the application layer to meet the applications submitted by users. The technical layer of the system includes application service, data integration, course quality evaluation module, database service, web service and information exchange. The system uses the technical layer to provide basic support for various

quality evaluation services of engineering cost education curriculum in the application layer. The infrastructure layer of the system includes processor control module, data acquisition module, CAN communication module and host computer. The system uses the infrastructure layer to provide hardware support for the quality evaluation system of engineering cost education curriculum. The display layer of the system includes administrator display interface, student display interface, teacher display interface and evaluation expert display interface. The display layer is used to serve the users of evaluation system such as evaluation experts, students and administrators. Users at different levels log in to different systems to complete different functions [14]. For example, evaluation experts mainly carry out evaluation, while students and teachers mainly carry out the quality evaluation of engineering cost education curriculum.

### 2.2 Design of system hardware

#### Processor control module

The processor control module is located in the infrastructure layer of the quality evaluation system of engineering cost education curriculum. The processor control module is mainly responsible for exchanging data with the can communication module, communicating with FPGA in the form of analog address / data bus, realizing the control of data acquisition and data storage, and finally processing the front-end digital signal of the sampled data [15]. DSP adopts the 32-bit fixed-point chip TMS320F2812 of TI company. The chip adopts 32-bit CPU, which greatly improves the processing capacity. The main frequency can work at 160 MHz, and its performance is far better than the C24X series products widely used at present. TMS320F2812 has not only digital signal processing capability, but also powerful event management capability and embedded control function. It is especially suitable for occasions with a large amount of data processing. Its main characteristics are as follows:

- (1) High performance static CMOS technology is adopted, and the main frequency can work at 160 MHz;
- (2) High performance 32-bit CPU, which can be carried out multiplication and accumulation operation of 16 bit  $\times$  16 bit and 32 bit  $\times$  32 bit;
- (3) On chip mass storage, 128 K  $\times$  16 bit Flash and 18 K  $\times$  16 bit data / program memory;
- (4) High speed peripheral interface, which can expand 1 M  $\times$  16 bit memory at most;
- (5) 3 32-bit CPU timers;
- (6) With 12 bit ADC, the minimum pipeline conversion time is 60 ms, and the single conversion time is 200 ms;
- (7) Improved eCAN2.0B interface module;
- (8) Multiple serial communication interfaces (two UARTS, one SPI and one McBSP);
- (9) High performance and low power consumption, using 1.8 V core voltage and 3.3 V peripheral interface circuit.

### Data acquisition module

The data acquisition module is located in the infrastructure layer of the quality evaluation system for engineering cost education curriculum. Figure 2 is the structural block diagram of the data acquisition module.

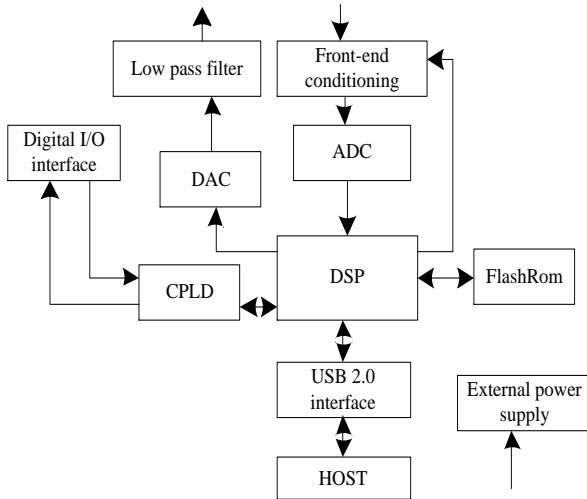


Figure 2. Diagram of data acquisition module structure

The data acquisition module uses DSP to receive various commands sent by the upper computer through CAN bus, complete the setting of system acquisition parameters, communicate with FPGA through address / data bus, send various control commands to FPGA, process external multi-channel analog input for signal selection and acquisition. Under the control of FPGA, AD collects and processes the quality evaluation data of engineering cost education curriculum in a certain way, and then transmits the processed data to the upper computer through CAN bus; the upper computer realizes various graphical interface operations and back-end signal processing, and analyzes the collected signals [16]. The system can synchronously sample the input multi-channel analog signals, which makes the collected quality evaluation data of engineering cost education curriculum not only contain the amplitude characteristics of analog signals, but also maintain the phase difference between different analog signals. The sampling frequency can be preset to meet the data sampling requirements of quality evaluation of engineering cost education curriculums at different rates.

### ADC unit

The ADC unit is located in the data acquisition module of the system infrastructure layer. The ADC unit adopts 16 bit ADC ADS8364 with high speed, low power consumption and 6-channel synchronous sampling, which is suitable for occasions with large noise and synchronous sampling. ADS8364 has 6 analog input channels, which are divided into 3 groups of A, B and C. Each group includes 2

channels. HOLDA, HOLDB and HOLDC respectively start the A/D conversion of 2 channels in each group. The timer output of DSP is used to control AD conversion. Since each channel has a sample holder and six ADCs are integrated inside, the six channels can sample and convert synchronously and in parallel. Bipolar input is adopted, and the input voltage range is  $\pm 5\text{ V}$ . The clock signal of ADS8364 is provided externally. The maximum frequency is 5 MHz. At the clock frequency of 5 MHz, the conversion time of ADS8364 is 3.2  $\mu\text{s}$ , the corresponding data sampling time is 0.8  $\mu\text{s}$ , and the total conversion time of each channel is 4  $\mu\text{s}$ , that is, its sampling frequency is 250 kHz, which has a very high speed. The timer output of DSP is used to provide external clock input for ADS8364.

The interface circuit between ADC and DSP is shown in Figure 3.

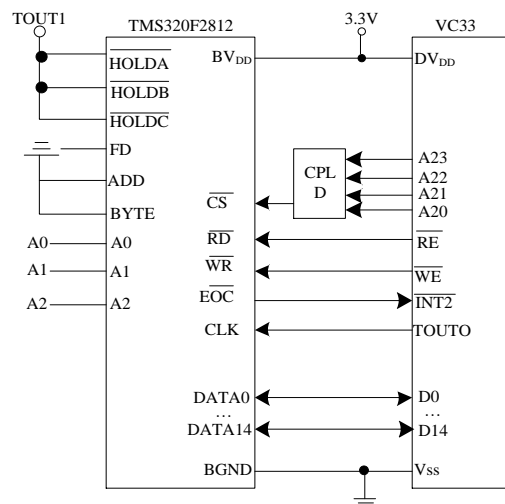


Figure 3. Diagram of DSP and ADC interface circuit

After A/D conversion, the conversion end signal EOC is generated and introduced into the interrupt pin of DSP. After each conversion, DSP interrupt is caused, and DSP reads the 16 bit conversion result into internal RAM. The address/mode signals (A0, A1, A2) determine how to read data from ADS8364. Single channel, cycle or FIFO mode can be selected.

### CAN communication module

The CAN communication module is located in the infrastructure layer of the quality evaluation system of engineering cost education curriculum. The system can use the CAN controller built in TMS320F2812 DSP without additional addition. It just add another CAN transceiver to form a CAN bus network. The bus has the advantages of strong real-time, long transmission distance, strong anti electromagnetic interference ability and low cost. Double wire serial communication mode is adopted, which has strong error detection ability and can work in high noise interference environment. And it has priority and arbitration functions. Multiple control modules are connected to the

CAN bus through the CAN controller to form a multi host local network to improve the overall performance of the system evaluation. Therefore, in order to improve the system performance, PCA82C250 is selected in this paper. This device provides differential transmission capability for the bus and differential reception capability for the CAN controller. It is the most widely used can transceiver. The main function of CAN bus communication module is to transmit the commands of the upper computer to DSP and the collected data to the upper computer for data storage and processing.

The data communication between upper computer and CAN bus mainly includes two aspects: reading sampling data and sending control commands to CAN controller embedded in DSP. To send a command, a command packet is firstly sent, and then subsequent data is sent or corresponding data is read from the controller according to the situation. It configures each break point in the firmware [17], sets different breakpoints to transmit commands to the upper computer or transmit data to the upper computer. The upper computer system uses Lab VIEW software to develop the application program, which mainly reads the preprocessed data from DSP, stores, displays the processing results and sends control commands to the system.

## 2.3 Cluster evaluation of fuzzy

### Matter-element closeness

In the quality evaluation of engineering cost education course, we should not only consider the fuzziness of each evaluation factor itself, but also consider the incompatibility between each factor. Because the quality of engineering cost education curriculum itself is fuzzy. Therefore, in order to improve the effectiveness of the evaluation in this system, the fuzzy matter-element proximity clustering algorithm in data mining method is used. In data mining algorithms, fuzzy matter-element clustering analysis is an important data clustering analysis method. Clustering analysis using the theory and method of fuzzy mathematics is called fuzzy clustering analysis. The results obtained by fuzzy cluster analysis are often more practical. On the basis of fuzzy matter-element analysis, combined with the concept of closeness, to improve the quality of engineering cost education curriculum [18], a fuzzy matter-element closeness clustering evaluation method is proposed.

### Concept of fuzzy matter-element

Fuzzy matter-element refers to the basic element that describes things with ordered triples: "things, features and fuzzy quantities". Changing fuzzy quantity value to quantity value is matter element. The symbol  $R$  represents the fuzzy matter-element,  $M$  represents the matter,  $C$  represents the feature of the matter, and  $\mu(X)$  represents the fuzzy quantity value corresponding to the feature  $C$  of the matter, that is, the membership of the matter  $M$  to the

corresponding quantity value of its corresponding feature  $C$ . Then there is the following expression:

$$R = \begin{pmatrix} M \\ C \quad \mu(X) \end{pmatrix} \quad (1)$$

Further, if  $m$  matters share their common  $n$  features  $C_1, C_2, \dots, C_n$  and their corresponding fuzzy quantities  $\mu_1(X_{1i}), \mu_2(X_{2i}), \dots, \mu_m(X_{mi}), (i = 1, 2, L, n)$ ,

$R_{mn}$  can be called  $n$ -dimensional fuzzy complex element of matters, which can be recorded as:

$$R_{mn} = \begin{pmatrix} M_1 & M_2 & L & M_m \\ C_1 & \mu_1(X_{11}) & \mu_2(X_{21}) & L & \mu_m(X_{m1}) \\ C_2 & \mu_1(X_{12}) & \mu_2(X_{22}) & L & \mu_m(X_{m2}) \\ M & M & M & O & M \\ C_n & \mu_1(X_{1n}) & \mu_2(X_{2n}) & L & \mu_m(X_{mn}) \end{pmatrix} \quad (2)$$

Where,  $R_{mn}$  represents the  $n$ -dimensional fuzzy complex matter-element of  $m$  matters,  $M_j$  represents the  $j$ -th matter,  $\mu_j(X_{ji})$  represents the membership of the corresponding quantity  $X_{ji}$  of the  $i$ -th characteristic of the  $j$ -th matter  $M_j, j = 1, 2, L, m, i = 1, 2, L, n$ .

Using the fuzzy matter-element theory, taking the individual college teachers as the research object, taking the quality evaluation index of engineering cost education curriculum for college teachers as the characteristic, and the evaluation result as the fuzzy quantity value [19], the membership value of the measured value of the fuzzy matter-element is determined according to the membership function in fuzzy mathematics.

### Determination of correlation function and its weight coefficient

There is correlation between two matters. The relationship between matters can be expressed by correlation function,

which is recorded as  $K(X)$ . According to the theory of fuzzy mathematics, the classical domain and node domain in the fuzzy matter-element coincide with each other, and the correlation function and membership function are equivalent to each other and can be transformed into each other, that is:

$$K_{ji} = \mu_{ji} = \mu(X_{ji}) \quad (3)$$

The importance of each evaluation index on the quality evaluation of engineering cost education curriculum is mainly reflected by the index weight coefficient. There are many methods to determine the weight coefficient, and

there are human factors to a great extent. In order to eliminate the influence of human factors, the standardized treatment of correlation function value is adopted to obtain the weight  $W_i$  expression of each evaluation index as follows:

$$W_i = \frac{\sum_{j=1}^m K_{ji}}{\sum_{i=1}^n \sum_{j=1}^m K_{ji}} \quad (4)$$

Where,  $n$ 、 $m$  represents the number of evaluation indicators .

### 2.3.3 Standard fuzzy matter-element and difference square composite fuzzy matter-element

According to the theory of preferential membership degree in fuzzy mathematics, the optimal value  $u_{si}$  of the membership degree of each evaluation index is taken to form the  $n$ -dimensional standard fuzzy complex matter element  $R^{sn}$ , and the expression is as follows:

$$R^{sn} = \begin{pmatrix} M_s \\ C_1 & u_{s_1} \\ C_2 & u_{s_2} \\ M & M \\ C_n & u_{s_n} \end{pmatrix} \quad (5)$$

$\Delta_{ji}$  represents the square of the membership degree difference between the optimal value of each evaluation index and the measured value between the standard fuzzy composite matter-element  $R^{sn}$  and the fuzzy composite matter-element  $R^{mn}$ , forming the composite fuzzy matter-element  $R_{\Delta}$  with the square of the difference, which can be recorded as:

$$R_{\Delta} = \begin{pmatrix} M_1 & M_2 & L & M_m \\ C_1 & \Delta_{11} & \Delta_{21} & L & \Delta_{m1} \\ C_2 & \Delta_{12} & \Delta_{22} & L & \Delta_{m2} \\ M & M & M & O & M \\ C_n & \Delta_{1n} & \Delta_{2n} & L & \Delta_{mn} \end{pmatrix} \quad (6)$$

Where,  $\Delta_{ji}$  represents  $\Delta_{ji} = (u_{si} - \mu_{ji})^2$ .

### Calculation of the closeness of each evaluation unit

According to the theory of fuzzy mathematics, there are many methods to calculate the closeness between two fuzzy matter-elements. According to the multi index to comprehensively evaluate the quality of engineering cost education curriculum, Hamming closeness is used in this

paper.

The following formula can be obtained by using  $R^{\rho_H}$  to represent the compound fuzzy matter-element of Hamming closeness:

$$R^{\rho_H} = \begin{pmatrix} M_1 & M_2 & M_m \\ \rho_{H_1} & \rho_{H_1} & \rho_{H_2} & \rho_{H_m} \end{pmatrix} \quad (7)$$

Where,  $R^{\rho_H}$  represents the Hamming closeness of the engineering cost education curriculum quality of the  $j$ -th teacher, that is, the closeness between the engineering cost education curriculum quality of the  $i$ -th teacher and the standard engineering cost education curriculum quality. In

the abstract, the coefficient  $\rho_{H_i}$  is a scale used to measure the closeness between the two. The greater its value is, the closer it is to each other (the better the quality of engineering cost education curriculums is). On the contrary, it means that the closer it is to each other (the worse the quality of Engineering cost education curriculums is). The

expression of coefficient  $\rho_{H_i}$  is:

$$\rho_{H_j} = 1 - \sum_{i=1}^m W_i \Delta_{ji} \quad (8)$$

Hamming's closeness degree is used to realize the quality evaluation of engineering cost education curriculum.

### Clustering research of classification criteria

According to the proximity selection principle in fuzzy mathematics, the shortest distance method is used to cluster by using Hamming proximity. The shortest distance method is to cluster analyze the Hamming closeness of each evaluation unit and divide the quality level of engineering cost education curriculum.

$d_{i_1, i_2}$  is used to represent the Hamming closeness between  $i_1$  and  $i_2$ ,  $G_1$  and  $G_2$  are used to represent the grade category, and the distance  $D^{pq}$  between  $G_p$  and  $G_q$  is used to represent the minimum value of the pairwise distance  $d_{i_1, i_2}$  of Hamming closeness of each sample in the two grade categories, namely:

$$D^{pq} = \min_{i_1 \in G_p, i_2 \in G_q} \{d_{i_1, i_2}\} \quad (9)$$

The correlation coefficient [20] between the two grade categories is analyzed, and an appropriate absolute threshold  $d_0$  is determined according to its mutation position. If  $D^{pq}$  is less than this value, it will be grouped into one category; On the contrary, those greater than this

value belong to two categories respectively. In the evaluation module, the fuzzy matter-element closeness clustering evaluation method in the data mining method is applied, the correlation function and its weight coefficient are determined, and the closeness of each evaluation unit is calculated. Finally, according to the proximity principle in fuzzy mathematics, the shortest distance method is used to cluster by using Hamming closeness. The shortest distance method is to cluster analyze the Hamming closeness of each evaluation unit and divide the quality level of engineering cost education curriculum.

### 3. Experimental analysis

#### 3.1 Experimental scheme

In order to verify the quality evaluation system of the designed engineering cost education curriculum and evaluate the effectiveness of the engineering cost education curriculum, the designed system is applied to the engineering cost specialty of an Architecture College of a university. The curriculums of engineering cost specialty include descriptive geometry and engineering drawing, engineering drawing and CAD, management principles, housing architecture, building materials, engineering mechanics, engineering structure, construction technology, project management, engineering economics, construction engineering valuation, civil engineering measurement, installation engineering construction technology, engineering cost management, etc. The professional titles of

teachers participating in the evaluation of the quality of engineering cost education curriculums are 42 professors and associate professors, 70 lecturers and 15 teaching assistants. In order to study whether there is a strong correlation between teachers' classroom teaching quality and teachers' professional titles, the grade differences between teachers with different professional titles are analyzed when evaluating the quality of teachers' engineering cost education curriculums. Teachers' titles are divided into three categories according to teaching assistants, lecturers and professors. According to the final total score, the quality evaluation results of engineering cost education curriculum are divided into five levels, of which 0-59 points are poor, 60-69 points are qualified, 70-79 points are medium, 80-89 points are good and 90-100 points are excellent.

#### 3.2 Analysis of experimental results

According to the analysis and induction of the evaluation indexes commonly used by experts, teachers and students, the quality evaluation index system of engineering cost education curriculum is divided into five first-class indexes: teaching attitude, teaching content, teaching method, teaching ability and teaching effect. 100 students are selected as the research object, and the system in this paper is used to evaluate the quality of engineering cost education curriculum. The calculation results of each index weight in the evaluation system are shown in Table 1.

Table 1. Weight calculation results of the evaluation index system

First level indicator	Weights	Secondary indicators	Weights
teaching ability	0.22	Vividness of language	0.12
		Clarity of teaching objectives	0.28
		Reasonable class time	0.31
		Practicality of courseware	0.18
		Classroom organization	0.11
		Classroom cohesion level	0.19
		Course interaction level	0.12
teaching method	0.17	Curriculum vividness	0.18
		Course inspiration	0.24
		Improve the level of thinking	0.18
		Teaching practice	0.09
Teaching content	0.18	Rigorous teaching content	0.24
		Reasonable teaching content	0.19
		Teaching system relevance	0.21
		Relevance to real life	0.36
		Correct teaching	0.25
Teaching attitude	0.31	Teaching affinity	0.19
		Teaching appeal	0.22
		Q&A level	0.15
		Lesson preparation level	0.19
Teaching effect	0.12	Completion of teaching objectives	0.24
		Active classroom atmosphere	0.15
		Classroom efficiency	0.26

As can be seen from the system test results in Table 1, the clustering evaluation method of fuzzy matter-element closeness adopted in this system can effectively calculate the weight of each index in the quality evaluation system of engineering cost education curriculum, and obtain more accurate quality evaluation results of engineering cost

education curriculum through the index weight.

According to the statistics, 100 students evaluate the quality of the construction engineering pricing course in the engineering cost education curriculum. The average evaluation results of various evaluation indexes are shown in Table 2.

Table 2. Quality evaluation results of construction engineering pricing courses

First level indicator	evaluation result/fraction	Secondary indicators	evaluation result/fraction
teaching ability	67.8	Vividness of language	75
		Clarity of teaching objectives	84
		Reasonable class time	56
		Practicality of courseware	64
		Classroom organization	58
teaching method	71.5	Classroom cohesion level	71
		Course interaction level	56
		Curriculum vividness	67
		Course inspiration	84
		Improve the level of thinking	64
Teaching content	61.9	Teaching practice	84
		Rigorous teaching content	59
		Reasonable teaching content	63
		Teaching system relevance	71
		Relevance to real life	58
Teaching attitude	75.7	Correct teaching	67
		Teaching affinity	72
		Teaching appeal	81
		Q&A level	74
		Lesson preparation level	86
Teaching effect	74.5	Completion of teaching objectives	71
		Active classroom atmosphere	68
		Classroom efficiency	82
The improvement of students' learning ability			74

The score of using the system in this paper to evaluate the quality of construction engineering valuation course is 70.6. As can be seen from the system test results in Table 2, the system in this paper can conduct a detailed evaluation on the construction engineering valuation course in the engineering cost education curriculum and obtain the evaluation results of the final engineering cost education curriculum. Curriculum managers in colleges and universities can put forward targeted improvement suggestions according to the students' evaluation results of the quality of engineering cost education curriculum, so as to provide basis for improving the quality of engineering cost education curriculum.

The quality evaluation results of a student on six engineering cost education curriculums: building materials, engineering mechanics, engineering structure, construction technology, engineering project management and

engineering economics are counted. The statistical results are shown in Figure 4.

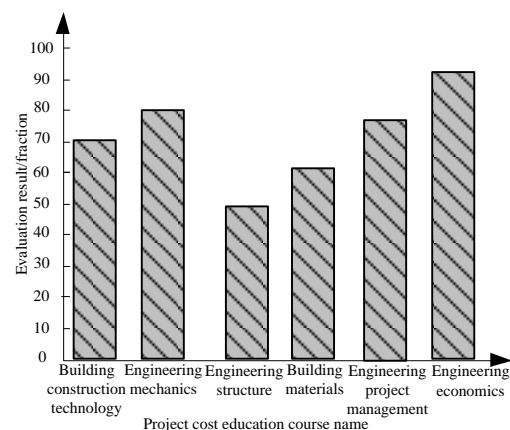
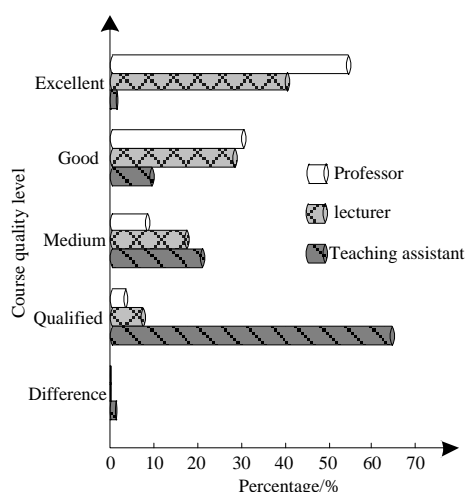


Fig 4. The quality evaluation results of six engineering cost education curriculums

As can be seen from the system test results in Figure 4, the effective evaluation of engineering cost education curriculum quality can be realized by using the system in this paper, and the course managers of colleges and universities can analyze the distribution of students' scores according to the students' evaluation results of engineering cost education curriculum quality. According to the evaluation results of students on the quality of engineering cost education curriculum, the main reasons for the increase or decrease of students' performance of engineering cost education curriculum are clarified, so as to improve students' learning performance of engineering cost education curriculum.

The quality evaluation of engineering cost education curriculums of teachers with different professional titles is analyzed according to their professional titles, so as to carry out corresponding ability improvement training for teachers with different professional titles and strengthen the construction of teachers. Different professional titles correspond to different levels of quality evaluation results of engineering cost education curriculum, as shown in Figure 5.

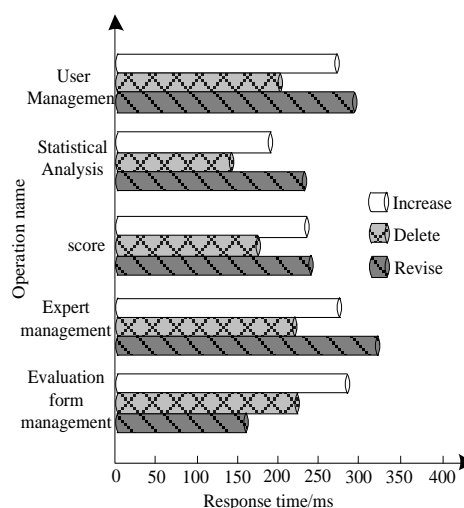


**Fig 5.** The proportion of teachers' professional titles in the evaluation of curriculum education quality

According to Figure 5, the proportion of professors in excellent and good levels is higher than that of lecturers and teaching assistants, less in medium and qualified levels, and the proportion of poor is zero. It is further analyzed that the high scores of professors in the evaluation of engineering cost education curriculums mainly fall in the aspects of

classroom organization ability and clarity of teaching objectives, and the indicators related to real life are lower than other indicators. The modern teaching method is to further train the professors. At the same time, it reflects that the professor has both depth and breadth in the professional knowledge of project cost, so students can learn more professional knowledge from the whole classroom teaching. In terms of teachers' attitude, teachers should correct their teaching attitude, carefully prepare lessons and make efficient use of classroom time. Students also need to actively participate in classroom teaching activities, achieve classroom teaching objectives and complete their homework on time. Schools should also pay attention to the improvement of teaching effect and improve students' ability and personal quality in all aspects.

Through the above experiments, it is verified that the designed system has high engineering cost education curriculum quality evaluation effectiveness. In the practical application of the system, there are a large number of concurrent users. When the number of concurrent users is 500, the operation performance of the system is counted, and the statistical results are shown in Figure 6.



**Fig 6.** System operation results

As can be seen from the system test results in Figure 6, the system can still maintain reliable operation under the condition of multiple concurrent users. When the number of concurrent users is 500, the system can still ensure stable user management, statistical analysis and other operations, and the response time of each operation is less than 400ms. The system operation test results verify that the designed

system has high stability. When the number of users is large, it can still maintain high operation performance, fast response time and high applicability.

### 3.3 Discussion

As an important aspect of teaching evaluation, education curriculum quality evaluation is not only the main part and foundation of education evaluation, but also has become an indispensable link in the teaching process. This paper studies the quality evaluation system of engineering cost education curriculum based on data clustering, applies data clustering to the quality evaluation of engineering cost education curriculum, and obtains high evaluation effect. The necessity of course quality assessment is as follows:

(1) The evaluation of educational curriculum quality is the need of developing modern education.

In order to develop education and truly realize the strategic requirements of modernization, it must firmly grasp the pulse of the times of educational development, always grasp the trend of the times of educational development, timely find, adjust and correct some disadvantages and deficiencies existing in the current education and teaching of regions or departments, and truly embark on the strategic track of modern education development to improve the quality of the whole nation and produce more and good talents. This not only requires educators to have farsighted wisdom and courage, but also the key is to deeply analyze, grasp, deal with and make decisions on the actual situation of education and teaching. Practical and effective supervision and inspection on the education situation of the school are carried out, especially the teaching situation, the central link of education work. As an important means to test the realization of teaching objectives and effects, teaching evaluation has become one of the basic works to explore and study the development strategy of modern education. Attaching importance to and studying teaching evaluation has become a common requirement of educational management all over the world. Teaching evaluation reflects the worldwide trend of the development and progress of modern education and the inevitable direction of modern education towards the future. It has become a practical need for the reform and development of modern education.

(2) The evaluation of educational curriculum quality provides decision-making basis for educational development.

The main purposes of educational curriculum quality evaluation are as follows: firstly, it can diagnose and improve teaching through educational curriculum quality evaluation; secondly, through the evaluation of educational curriculum quality, it helps relevant departments make corresponding decisions on teachers' teaching; thirdly, through the evaluation of educational curriculum quality, it help students choose courses and make learning plans; fourthly, it can provide information on students' learning to relevant parties through education curriculum quality evaluation; Fifthly, through the evaluation of educational curriculum quality, it can test the realization of teaching effect and expected teaching objectives, so as to provide information and decision-making basis for education and teaching itself. By carefully organizing and carrying out teaching evaluation, we can find out the problems existing in the process of education and teaching, find out the deficiencies or gaps, so as to take corresponding countermeasures and measures in time, properly control and adjust, correct the uncomfortable parts that deviate from the teaching objectives, maintain a virtuous circle comprehensively and continuously, and promote the continuous improvement of teaching quality.

(3) The evaluation of educational curriculum quality is conducive to the progress and improvement of teaching, scientific research, teaching reform and teaching management.

The development of education and the improvement of teaching quality are inseparable from the improvement of teaching level, scientific research level and teaching management level. The progress and improvement of teaching, scientific research, teaching reform and teaching management level depend not only on the conscious and unremitting efforts of educators, but also on external supervision and detection. Teaching evaluation, as an indispensable means of detection and supervision in the teaching process, is bound to promote the continuous improvement of teaching, scientific research, teaching reform and teaching management. Teaching evaluation can not only play a self-awareness role in finding the gap

according to the standards, but also arouse the incentive of comparison, learning, catching up, helping and surpassing among the evaluated and between the backward and the advanced. The timely feedback of teaching evaluation information and the timely summary of advantages and disadvantages in the teaching process not only make the assessed clear the direction they need to learn and improve in the future, help the assessed adjust their teaching activities in time, but also promote them to actively transform the objective evaluation criteria into their internal motivation, urge them to pay attention to constantly absorb each other's strengths, improve their quality and literacy, and improve teaching and in-depth teaching and research, so as to improve their actual work, and fundamentally promote the improvement of the whole teaching, scientific research, teaching reform and teaching management level.

(4) A teaching quality assurance system is established through the evaluation of educational curriculum quality.

Establishing a mechanism to ensure and improve the quality of teaching can gradually establish a mechanism to regularly provide the society with relevant information about colleges and universities, so as to meet the needs of students or parents to choose schools; enable schools to receive social understanding and support while accepting social supervision; enhance the ability to adapt to environmental changes and improve the ability of survival and development in the fierce competition in the talent market and education market. Ensuring the credibility of school education and teaching quality is conducive to ensuring school teaching quality and adapting to the rapid development trend of world higher education. Teaching evaluation can guide the school to clarify the guiding ideology of running a school, change the educational concept, promote leaders at all levels to attach great importance to teaching work, increase teaching investment, improve school running conditions, promote the reform of talent training mode, teaching content and curriculum system, strengthen the construction of teachers, promote the innovation of teaching management system in colleges and universities, and improve the management level and efficiency of teaching management.

## 4. Conclusion

With the continuous development of digitization, the classroom teaching quality evaluation of engineering cost education course should be more real-time. Developing an effective engineering cost education course quality evaluation system is an effective solution. Therefore, this paper designs a quality evaluation system of engineering cost education curriculum based on data clustering. The data acquisition module of infrastructure layer is used to collect the quality evaluation data of engineering cost education course, and the collected data is transmitted to the upper computer by can communication module. The processor control module in the upper computer transmits the data to the course quality evaluation module, and the processor control module selects 32-bit fixed-point chip TMS320F2812; After receiving the data, the course quality evaluation module uses the fuzzy matter-element proximity clustering evaluation method in data mining to evaluate the quality of engineering cost education courses. The evaluation results are transmitted to the application layer for users to use, and the evaluation results are displayed to users through the display interface of the display layer to complete the system design. The experimental results verify the effectiveness of the proposed system. Although this system has some advantages in the current design, there are still many deficiencies. More parameters will be considered in future research to improve the accuracy of system evaluation.

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