Design of Online Evaluation System for Blended Teaching in Vocational Education

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Abstract. Blended teaching of vocational education includes online and offline teaching. Using online means to evaluate students' academic performance has the advantages of real-time and efficiency. Aiming at the online evaluation module, this paper divides the course performance index, most of the structure, structure principle, technical inspection, maintenance, troubleshooting modules into subjects, and designs the process framework of the online evaluation system. Through the determination of the evaluation object, the selection of the evaluation index, the determination of the single evaluation index, the determination of the index weight, the completion of the evaluation of the students' comprehensive performance. Combined with examination management and student operation terminal, the online evaluation of vocational education blended teaching is realized.

Keywords: Vocational Education, Online Assessment, Blended Teaching.

1 Introduction

Blended teaching is a kind of teaching method that integrates traditional face-to-face teaching and online learning[1]. It has the advantages of rich learning resources, independent learning methods and various learning means. With the continuous development and expansion of intelligent network and information resources, the teaching mode has been constantly improved[2][3].

The overall design, organization and implementation of blended teaching of vocational and technical education decide that its assessment and evaluation should be carried out by the combination of online evaluation and offline evaluation[4]. Online evaluation columns mainly include attendance, homework, questions, tests, etc., while offline evaluation methods mainly include classroom performance, personal training, class and group training, and comprehensive practical training assessment. In the process of assessment organization and implementation, online and offline assessments are generally supplemented, and formative and final assessments are combined[5][6].

2 The framework process design of evaluation system

Blended teaching in vocational education gives full play to the advantages of online and offline teaching. The content modules are: performance indicators, most of the structure, institutional principle, technical inspection, maintenance, and fault elimination[7][8].

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When an assessment is required, students are required to first log in and select an exam subject. After logging in the system, the system extracts questions from the question bank to automatically generate examination subjects. After the student submits the answer, the system compares the result with the question bank and gives the score (see Fig 1). The data acquisition unit collects training scene data, equipment simulator state and other simulation data sent by the command data end, operation instructions sent by students, instructions sent by teachers and other data, and extracts the required data and records it in the storage module, and forwards it to the evaluation unit after training. The evaluation model is supported by the relevant equipment database and expert system library, combined with the content of the training subject, and gives the evaluation results according to the training data recorded by the data acquisition unit. In the evaluation process, teachers can choose whether to modify or set the evaluation model parameters or directly participate in the evaluation.

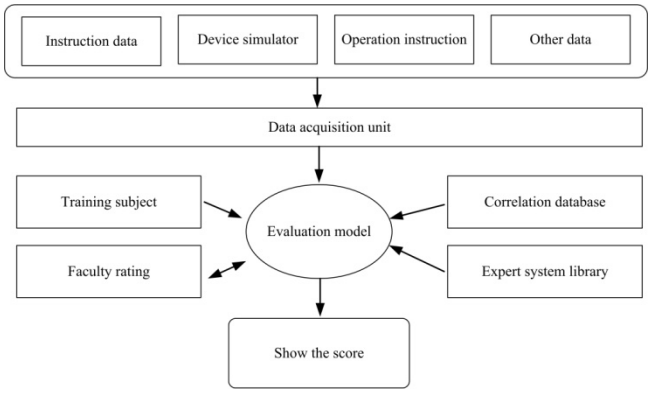

Fig. 1. Schematic diagram of online training scoring process

3 Design of evaluation system

The idea of online assessment is to input the information such as content module, operation step and true or false judgment output of the assessment module to obtain the assessment result, which provides the basis for the comprehensive assessment training process. The specific methods are:

3.1 Determine the object of evaluation

The assessment object is the learning level of the participants, including theoretical knowledge and practical operation.

3.2 Selection of evaluation indicators

Considering the comprehensiveness, integrity, safety and proficiency of the assessment subjects, the evaluation indexes are designed as follows: error proportion coefficient, subject completion coefficient, assessment time, and difficulty level of the subject type.

3.3 Determine the performance of individual evaluation indicators

According to each evaluation index, the corresponding training performance is given to get a single index evaluation.

Error ratio coefficient. This coefficient is the number of incorrect questions in the theoretical examination and the number of operational errors in the operational examination. The error proportional coefficient is represented by C_1, n_f is the number of misoperations, n_{max} is the maximum number of misoperations allowed, then the error proportional coefficient is expressed as follows:

$$C_1 = \begin{cases} 1 - \dfrac{0.5 n_f}{n_{\max}}, n_f \le n_{\max} \\ 0, n_f > n_{\max} \end{cases} \tag{1}$$

Then the performance of this index is: $J_1=\lambda_1 C_1$. In the formula, λ_1 is the weight value of the misoperation index[6].

Subject completion factor. The subject completion coefficient is represented by Q.

$$Q = \frac{m_z}{m_{\max}} \tag{2}$$

In the formula, m_{max} is the maximum operation step of the subject, and m_z is the step completed by the subject.

The performance of this index is: $J_2=\lambda_2 Q$. In the formula, λ_2 is the weight value of the subject completion index.

Assess the time coefficient. The assessment time coefficient is represented by C_2, the system sets the assessment time as T_{all}, and the actual time in the assessment process is T_s.

$$C_2 = \begin{cases} 0, T_s > T_{all} \\ 1 - \dfrac{0.5 T_s}{T_{all}}, T_s \le T_{all} \end{cases} \tag{3}$$

The performance of this index is: $J_3=\lambda_3 C_2$. In the formula, λ_3 is the weight value of the assessment time index.

The difficulty level of the subject. The difficulty level of the subject is represented by C_3, which is specified by the difficulty level of the question bank. The higher the level, the higher the coefficient C_3 should be set.

The performance of this index is: $J_4=\lambda_4 C_3$. In the formula, λ_4 is the weight value of the subject difficulty index.

3.4 Determine the weight

After the achievement of individual assessment indicators is determined, it is often the case that not all assessment indicators are equally important to the assessment outcome. Therefore, it is also necessary to determine the weights of each indicator, which can be given by experts.

In this paper, three-scale AHP method is adopted to estimate the weight of each evaluation index according to the idea of importance, that is, the relative importance of each index is estimated to reflect the importance of different indicators to the evaluation results. Three-scale method refers to the pairwise comparison of index importance, which is described as follows:

The judgment matrix A is established.

$$D_{ij} = \begin{cases} 1, \text{Indicator i is more important than indicator j} \\ 0, \text{Indicator i is just as important as indicator j}, \forall i, j \\ -1, \text{ Index i is not as important as index j} \end{cases} \tag{4}$$

Calculate the optimal transfer matrix of judgment matrix.

$$Z_{ij} = \frac{1}{M} \sum_{a=1}^{m} (D_{ia} + D_{ja}), \forall i, j, \text{m is the order of D} \tag{5}$$

Find the consistency matrix P.

$$p_{ij} = \exp(Z_{ij}), \forall i, j \tag{6}$$

Calculated weight. The eigenvector corresponding to the maximum eigenvalue of P is calculated, and then the eigenvector is normalized, and each component obtained is taken as the relative weight of each index.

In the research topic, according to the pairwise comparison of the importance of evaluation indicators, the judgment matrix D is first obtained.

$$D = \begin{bmatrix} 0 & -1 & 1 & 0 \\ 1 & 0 & 1 & -1 \\ -1 & -1 & 0 & -1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

Calculate in turn

$$Q = \begin{bmatrix} 1 & e^{-0.25} & e^{0.75} & e^{0.5} \\ e^{0.25} & 1 & e & e^{-0.25} \\ e^{-0.75} & e^{-1} & 1 & e^{-1.25} \\ e^{0.5} & e^{0.25} & e^{1.25} & 1 \end{bmatrix}$$

Thus, the weight is calculated as A=[0.198,0.191,0.293,0.318]. That is λ_1=0.198, λ_2=0.191, λ_3=0.293, λ_4=0.318.

3.5 Determining comprehensive results.

The comprehensive assessment score is determined by using the weight reweighting of individual assessment indicators:

$$J = J_1 + J_2 + J_3 + J_4 \tag{7}$$

4 Implementation of online evaluation system

Taking a certain course as an example to achieve online evaluation, firstly complete the evaluation setting of different knowledge modules according to the course structure. The online evaluation system is divided into two parts: assessment management and student operation.

The assessment management process is divided into three steps, including program generation, program management and performance statistics.

program generation. Click " program generation " under evaluation in the left navigation bar, and the first step setting of online test setting (setting of test information) interface is displayed on the right (see Fig 2). In this step, the administrator can set the number of questions, difficulty, operation subjects, and operation time. After the setting, the online test solution is generated.

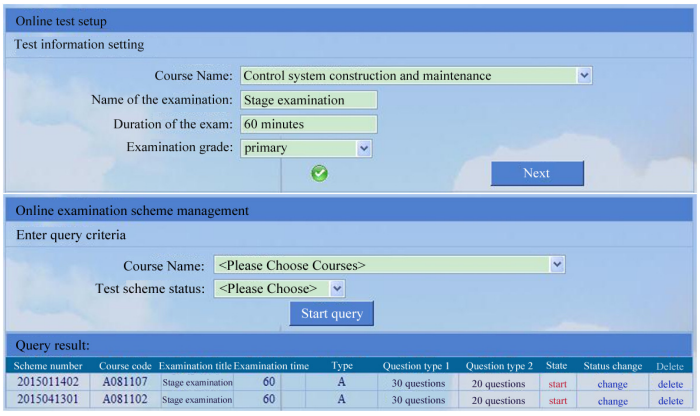

Fig. 2. Setting online test information(left) and Online evaluation status modification and deletion page(right)

program management. There are two online assessment states. In the "start" state, candidates can carry out online assessment and hand in the paper. The "Finished" status indicates that the online assessment is over and the test can no longer be assessed online. Administrators should modify it according to the actual online evaluation status. If online evaluation is required, it must be changed to "start" status; If the online assessment is completed and the examinee has handed in all the test papers, the administrator should change the status to "finished" and no longer use the online test. The specific method to modify the status is to query the name of the current test scheme and click "Change" as prompted to modify the status (see Fig 2).

Performance Statistics. Score statistics are used to view final test scores for online assessment. Click "Score Statistics" in the left navigation bar, and the online scheme query interface will be displayed on the right. Input the query conditions successively, click the "query" button, and the list of relevant schemes will be displayed below. Click the link "Score Statistics", and the list of scores of each examinee corresponding to the test will be displayed below (see Fig 3).

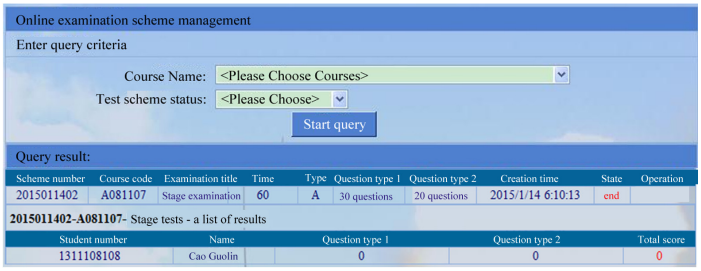

Fig. 3. Score statistics page(left) and Confirming the test name screen

5 Conclusions

Through the design of vocational education blended teaching online evaluation system, we solve the problem of personnel learning evaluation in online learning training. Through this system, the learning effect of the trainees can be quantified and the situation of the trainees can be reflected in time. According to the test results of the evaluation system, teachers can adjust the teaching ideas and contents in time to further improve the learning effect of blended teaching.

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