Research on Education Performance Evaluation Based on Characteristic Index Vector Analysis

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Abstract: The research on the performance of cultivating innovative and entrepreneurial talents in higher vocational colleges is to combine the teaching theory of innovation and entrepreneurship education with the practice of university parks, form new thinking of innovation and entrepreneurship education, and cultivate a number of innovative and entrepreneurial talents in the new era. This paper proposes the design of teaching performance model based on data decision. With the method of characteristic index information sampling, the sample data of educational resource service performance are obtained. Combined with the optimal strategy to track the human resource management and service performance of colleges and universities, the cost function of education index performance management is constructed. Based on the characteristic index query and optimization control of education performance management, the performance prediction is carried out, and the design of human resource service performance model based on characteristic index vector is realized.

1. Introduction
When setting the general index, single index and detailed index of the performance of cultivating innovative and entrepreneurial talents in higher vocational colleges, through experimental test and expert demonstration, it has high scientificity, rationality and credibility, and can effectively promote the cultivation of innovative and entrepreneurial talents and effectively promote "Innovation leading entrepreneurship, entrepreneurship driving employment", which provides higher reference value for the theory and practice of college students' innovation and entrepreneurship, employment expansion and career creation. However, there are still subjective factors and human factors in the setting of performance indexes, which will affect the accuracy of statistics and the reliability of conclusions to a certain extent. It is also inevitable that there are problems of objectivity and integrity of data in the survey. It is suggested that the performance indicators should be combined with the actual situation of colleges and universities, and the variance and standard deviation should be determined by regression analysis, and the statistical data should be adjusted and revised reasonably to ensure that the data are more comprehensive, accurate, systematic and scientific, and provide scientific prediction and decision-making for the cultivation of innovative and entrepreneurial talents in higher vocational colleges [2].

In order to realize the education performance model based on characteristic index vector and accelerate the transformation of teaching from simple function management to information management, this paper constructs the big data information analysis model of education performance statistics by information fusion through educational performance statistical analysis method. Through the acquisition of information data, the new data characteristics are analyzed.
2. Education performance model based on characteristic index vector analysis

With the characteristic index sampling method, the sample data of educational performance are obtained:

\[ T(r, i, j) \]

\[ \hat{R}_r(T(r)) + \hat{R}_i(T(i)) \geq R_{\text{mac}}(W_i^0, W_j^0) \]

(1)

In Formula 1, \( T(r, i, j) \) represents the data set of educational performance, \( \hat{R}_r(T(r)) \) represents the objective measure of teaching achievement, \( W_i^0 \) represents the critical value of target effect, and \( \hat{R}_i(T(i)) \) represents the optimal characteristic quantity of educational performance [3].

After obtaining the sample data of educational performance, it is necessary to analyze the characteristics of the sample data to facilitate the subsequent education performance analysis. In this paper, the optimal closed stability method is used to analyze the characteristics of service performance in teaching process, and the optimal characteristics of teaching performance are obtained. The teaching decision-making function is constructed by the obtained service performance characteristics, and the decision-making weight of educational performance can be judged by this function [4-6]. With the characteristic degree subspace fusion clustering method, the decision function of university education performance characteristics is obtained as follows:

\[ p_j(k) = \left(1 - \frac{\sigma_j(k)^2}{\omega_j(k)}\right)^+, k = 1, \ldots, r_j \]

(2)

In Formula 2, \( \mu_j > 0 \), \( \mu_j \) is the characteristic variable of educational performance decision-making, \( \omega_j \) is the decision-making factor of educational performance characteristics, and \( \sigma_j \) is the cost-oriented goal. In this function, the higher the decision-maker's decision-making ability is, the more problems in teaching can be identified [7,8].

On this basis, through convex optimization combination analysis, the prediction rule function of university education performance model is obtained as follows:

\[ p_i(k) = \left(1 - \frac{\sigma_i(k)^2}{\omega_i(k)}\right)^+, k = 1, \ldots, r_i \]

(3)

In Formula 3, \( \mu_i \) satisfies

\[ \sum_{k=1}^{r_i} \log \left(1 + \frac{1}{\mu_i \sigma_i(k)}\right) = R_{\text{mac}}(W_i^0, W_j^0) \]

(4)

Through the prediction rule function of resource service performance model, the data characteristics in big data information model are determined, and the related data of education service performance are predicted, and then the big data information analysis model is constructed. Through information clustering and characteristic optimization sampling method [9], the big data information analysis model is constructed as follows:

\[ \sum_{k=1}^{r_i} \left(1 - \frac{\sigma_j(k)^2}{\omega_j(k)}\right)^+ \leq p_j \sum_{k=1}^{r_i} \left(1 - \frac{\sigma_i(k)^2}{\omega_i(k)}\right)^+ \]

(5)

The optimal values of \( p_j(k) \) and \( p_i(k) \) are obtained by big data analysis model, and the construction of big data analysis model of education performance statistics is realized.
2.1 Characteristic extraction of educational performance
In order to realize the optimization of university education performance model, it is necessary to extract the characteristic quantity of subject model of university teaching. In this paper, deep query method is used to query and optimize the characteristics of education performance management [10].

Assuming that the sample value of educational performance characteristics is \( X_p \), the stable solution of the auxiliary decision-making formula of educational performance management is as follows:

\[
E[\tilde{e}_{1hk} \tilde{e}_{2k2}] = \begin{cases} 
\alpha \\
\rho \\
\gamma 
\end{cases} 
\]

In Formula 6, \( \alpha, \beta, \gamma, \) and \( \rho \) are the orders of \( e \) of educational performance management decision sequence. Through this stable solution, the characteristic quantity of university human resource performance is determined.

The programming formulas of educational performance management will contain \( 2^k \times (N+1) \) formulas. The state space compression method is used to simplify the solution of educational performance management problems. With the multi-dimensional characteristic prediction method, the decision-making optimization function is obtained as follows:

\[
V^*_{\rho,\beta}(q(n-k)) = V^*_{\rho,\beta}(q(n-k) + \alpha \hat{o})
\]

Let \( x=q(n-k)+\alpha \hat{o} \), considering \( q(n-k) \geq k \), the dynamic programming formula of educational performance prediction is as follows:

\[
V^*_{\rho,\beta}(x) = (P, B)(x) + \beta((P, V^*_{\rho,\beta})(x) + \beta \min\{0, \mu(V^*_{\rho,\beta}(x) - V^*_{\rho,\beta}(x-1))
+ (1-\mu)(V^*_{\rho,\beta}(x+1) - V^*_{\rho,\beta}(x)) - \frac{1-\mu}{\beta} \}
\]

Under the condition of \( q(n-k) \geq k \), through characteristic decomposition, it is found that there are \( x \) variables in education performance prediction, which are reduced from \( 2^k \times (N+1) \) dimension to \( x \) dimension, among which \( x=q(n-k) \leq N + \alpha \hat{o} \). According to the above analysis, a characteristic extraction model of educational performance is established, and data decision and planning are carried out according to the results of characteristic extraction.

2.2 experimental parameters
According to the characteristic extraction model, the characteristics of educational performance are extracted. According to the extracted characteristics, the number of nodes of human resource information sampling is set as \( N=50 \), and the faculty and staff of the university are divided into four groups with 25 people in each group. The specific parameters are shown in Table 1

| Table 1 Educational performance configuration parameters |
| --- |
| Parameter | Value |
| Educational performance nodes/pcs | 12 |
| Service performance complex data size / bit | 345 |
| HR transfer rate (pcs/s) | 0.2 |
| Information fusion interval /min | 5 |
| Fusion time /s | 100 |
| Statistics / person | 100 |
| Times of information fusion/times | 10 |
According to the rules of the prediction rule function, the service quality of the four groups of employees is evaluated according to the satisfaction (> 95 points), general (85 ~ 94 points) and dissatisfaction (< 85 points), and the obtained results are obtained according to the clustering convergence conditions. The actual evaluation results are shown in Table 2.

| Group number | Satisfaction /score | General /score | Dissatisfaction /score |
|--------------|---------------------|----------------|------------------------|
| 1            | 95                  | 86             | 82                     |
| 2            | 98                  | 87             | 81                     |
| 3            | 97                  | 88             | 79                     |
| 4            | 97                  | 87             | 73                     |

According to the setting of the above parameters, the characteristics of university education performance are extracted, and the effectiveness of education performance model is tested.

2.3 Experimental indexes
In order to verify the effectiveness of this model in human resource management, the experiment compares the evaluation accuracy and efficiency of this model, BSC matter-element model and triangular characteristic multi-attribute decision-making evaluation model, so as to verify the effectiveness of this model.

3. Analysis of experimental results

3.1 accuracy analysis of different models
In order to verify the validity of the model, the service quality of the staff of the University is evaluated through 10 experiments. Comparing the evaluation accuracy of this model, BSC matter-element performance evaluation model and triangular characteristic multi-attribute decision-making evaluation model, the experimental results are shown in Fig. 1.

![Fig. 1 Comparison of the accuracy of different models of education performance evaluation](image)

Analysis of Fig. 1 shows that there are some differences in the accuracy of the three models in evaluating educational performance. When the number of experiments is 4, the accuracy rate of this model is about 91%, that of BSC matter-element performance evaluation model is about 63%, and that of triangular characteristic multi-attribute decision-making evaluation model is about 79%; when the number of experiments is 10, the accuracy rate of this model evaluation is about 98%, and that of BSC matter-element performance evaluation model is about 65% %The evaluation accuracy of the model is about 82%. Through the comparison of the accuracy data of the three models, it can be seen that the effect of this model is better, up to 98%, and has certain reliability.
3.2 Efficiency analysis of different models of educational performance evaluation

In order to verify the application effect of this model in education performance, the evaluation efficiency of this model, BSC matter-element performance evaluation model and triangular characteristic multi-attribute decision-making evaluation model are compared, and the evaluation time of each model is recorded. The experimental results are shown in Fig. 2.

![Comparison of service performance evaluation time of different models](image)

Fig. 2 Comparison of service performance evaluation time of different models

It can be seen from Fig. 2 that the evaluation time of the three models changes with the change of the number of experiments. When the number of experiments is 3, the evaluation time of this model is about 3 s, the time of BSC matter-element performance evaluation model is about 15 s, the evaluation time of triangular characteristic multi-attribute decision-making evaluation model is about 12.5 s; when the number of experiments is 7, the evaluation time of this model is about 4 s, and the time of BSC matter-element performance evaluation model is about 10 s. The evaluation time of the model is about 11 s. Through the comparison, it can be seen that the evaluation of the model in this paper takes a short time, has a high efficiency and is feasible to some extent.

4. Conclusion

In order to accelerate the transformation of the quality management of higher education resources from the pure performance management to the social demand performance, and to realize the optimal allocation of teacher resource management in the education system, this paper proposes an educational performance model based on eigenvectors. Through the collection of information data, the characteristics of new data are analyzed, and the data information analysis model of educational resource management is constructed. Through the experimental comparison, it can be seen that the evaluation of the model in this paper takes a short time, has a high working efficiency, and has certain feasibility.

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