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Education E-government performance comprehensive evaluation index system of analysis and design in colleges and universities

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ABSTRACT

This paper expounds the design principle of E-government performance evaluation index system in colleges and universities, explains the construction process of comprehensive evaluation index system, and accounts for the dimension of comprehensive evaluation index system. By using Delphi method and analytic hierarchy process(AHP), it gets primary index weight and secondary index weight, thus building a relatively complete colleges and universities E-government performance evaluation index system.

KEYWORDS

Education E-government; Performance; Comprehensive evaluation index system.

Education e-government construction is an important part of the national electronic government affairs and education informationization, is an important means of promoting the modernization of education. For the transformation of the mode of work and attitude, further improve the work quality and efficiency of the important task of the current colleges and universities to promote the building of e-government, and achieved some results, but overall, there is still a big investment, the problem such as high investment and low efficiency, small output of e-government construction of colleges and universities is far from meeting the requirement of the education reform and development of our country. International practices and studies have shown that the e-government project there is a high degree of risk, the probability of failure is extremely high, therefore, the western countries a large number of research institutions, consulting companies and scholars have carried out the study of e-government performance evaluation. To guide the healthy and orderly e-government's construction in colleges and universities, sustainable development, in-depth discussion and research to perfect, scientific education e-government performance evaluation index system of colleges and universities are imperative[1-3].

THE INDEX SYSTEM DESIGN PRINCIPLES

In order to build scientific and reasonable evaluation index system, we must abide by the principles of guidance, completeness, science, feasibility, and development[4]:

Scientifie Principles

The index system should embody the science, abide by the laws and characteristics of education E-government, and accurately reflect the basic features of evaluation object, as well as the actual level and effect during the implementation process with the attitude of being pragmatic and realistic. The science of index includes rationality, as well as the consistency, independency and compatibility of index and targets.

(1)Uniformity of Index and Content

The index system should cover all the contents and information in order to achieve the evaluation target, which should be closely followed by the whole index system layer by layer, so that the final evaluation conclusion can accurately reflect the evaluation intention.

(2)Index of independence

Each index should be relatively independent and clear in connotation. Each index at the same level should avoid being overlapped, identical in connotation, or intersect in extension. Logically speaking, it should be away from identical, overlapping, causal, or contradictory relations, but only with coordinate relation.

(3)Index of coordination

Each index should be consisted, to avoid contraction and conflicts, thus reflecting the requirements of target from edgewise aspect.

(4)Index of objectivity

We should abide by scientific informationization theory, and statistical method. Meanwhile, we should make sure that the index system is fair to all the evaluation targets, while the evaluation system should not partial to some learning content, learning method or learning stage, so as to avoid or reduce the subjectivity in evaluation to the greatest extent.

Orientation Principles

Evaluation index system plays a guiding role in enhancing and improving education E-government performance. Therefore, when we are establishing index system, we should observe the selection of index factors, as well as the determination of factor content and evaluation standard. Meanwhile, we should emphasize the main factors and education E-government characteristics that influence education E-government, which should reflect the basic requirements for education E-government quality, and also make every factor the measurement for education E-government staff to conduct self-check, as well as the targets that can be attained in the near future. We should guide colleges and universities to obtain the education E-government targets through the distribution of each evaluation factor and weight in the evaluation index system.

Feasibility Principle

The education E-government involves wide areas, while the index system cannot involve all aspects. Therefore, we need to carefully analyze, and master the main contradiction. We need to ensure the integrity of the index system, and simplify the index factors to the most extent, to make it easier to be operated, but not being away from the current teaching situation. Each evaluation index should be concrete and specify in content, independent in connotation and extension, distinct in wording, and clear in semantic meaning, which is the regulation for action and operation of teaching. It is easy to collect data, with stable data sources, as well as consistent data standard and range, so it is easily to be observed and measured by evaluators. To sum up, formulating index system can measure teachers' comprehensive quality on one hand, and provide convenience to operate during the evaluation process on the other hand.

Dynamic Developmental Principles

The education E-government is a dynamic developmental course, the education E-government performance evaluation should be continuously improved along the course of development. Therefore, we should appropriately revise the established evaluation index system after applying for certain period in accordance with the development and requirement of the situation, so as to enhance the consistency between the education E-government evaluation and the education E-government target, and also improve the efficiency of the education E-government evaluation.

Principle of Systematization

The evaluation index system should abide by the systematization of index, which requires the education E-government performance evaluation index system not to oversight any important information, but to comprehensively, systematically, and constitutionally reflect every factor that reproduces and covers the education E-government performance. The more comprehensive and systematic evaluation index system can better reflect the nature of evaluation object, and the evaluation result will be more accurate. However, it should be remembered that we cannot extremely pursue the completeness, but get away from reality, so when we are designing situation index system, we should define the factors that can best reflect the attributes of evaluation object and best meet the requirements of the target as the index in accordance with the characteristics of evaluation target, as well as concrete evaluation targets. We should also ignore and abandon some secondary and non-essential evaluation factor, to combine the comprehensive situation and pay attention to key point.

PROCESS TO BUILD THE EDUCATION E-GOVERNMENT PERFORMANCE EVALUATION INDEX SYSTEM

Goal Decomposition

First, decompose the total evaluation goal into several sub goals (primary index), which can be further decomposed into several sub sub goal s (secondary index) in accordance with the complexity of sub goals. Meanwhile, we should carefully analyze the factors (tertiary index) that involved by each sub sub goal (sub target), and arrange all these factors without omitting.

Sorted generalization

Through comprehensively making use of the methods such as literature study, comparative study, interviewing, induction, and deduction, this paper conducts comparative analysis between the existing evaluation index and the evaluation index generates from the above mentioned analysis, and learns from it. Meanwhile, through induction and deduction, it selects each factor, to get rid of the unessential and insignificant factors, incorporate the factors of the same class, and regulate contradictory factors or those with causal connection.

Comprehensive Comparison

Integrated use of literature research, comparative study method, interview method and inductive and deductive method, the preceding analysis to generate the evaluation index of comparing with the existing evaluation index analysis, draw lessons from, summed up the more comprehensive, objective and accurate evaluation index, form the preliminary indicator framework.

Test and Verification

Select appropriate evaluation target to conduct test in small scale. Meanwhile, revise the evaluation index in accordance with the test results, and then shape preliminary index framework.

Revise and Perfect

By making use of Delphi method, index framework is determined through rounds of questionnaire surveys and expert consultations. Then, the factors need to be investigated are further analyzed and selected, and then sequenced through expert judgment, to determine the key factors to be investigated.

Confirm the Weights

Determine the index weights by applying analytic hierarchy process, and finally obtain the complete index system.

THE EDUCATION E-GOVERNMENT PERFORMANCE EVALUATION INDEX SYSTEM OF DIMENSIONAL ANALYSIS

The following part will specifically analyze the four primary indexes to evaluate Education E-government Performance evaluation, while the value of which is mainly judged from these four dimensions through collecting data.

Information infrastructure(II)

Information infrastructure consists of four secondary indexes, including Computer products per capita(CPPC),The computer network scale(CNS),Network performance level(NPL),Information security infrastructure(ISI)

The Application System(AS)

The application system includes five secondary indexes, namely Office business application system construction(OBASC),Construction of e-government information resources and database(CEGIRD),Construction of government information publicity(CGIIP),The portal website construction(PWC),Software is the original condition(SOC).

The Costs and Benefits(CB)

It consists of four secondary indexes, including The hardware and software and personnel training and operation(HSPTO),Office quality and efficiency(OQE),Administrative fees for lower rates(AFLR),Scientific decision-making level ascension(SDLA),The teachers and students and social satisfaction(TSSS).

Support System(SS)

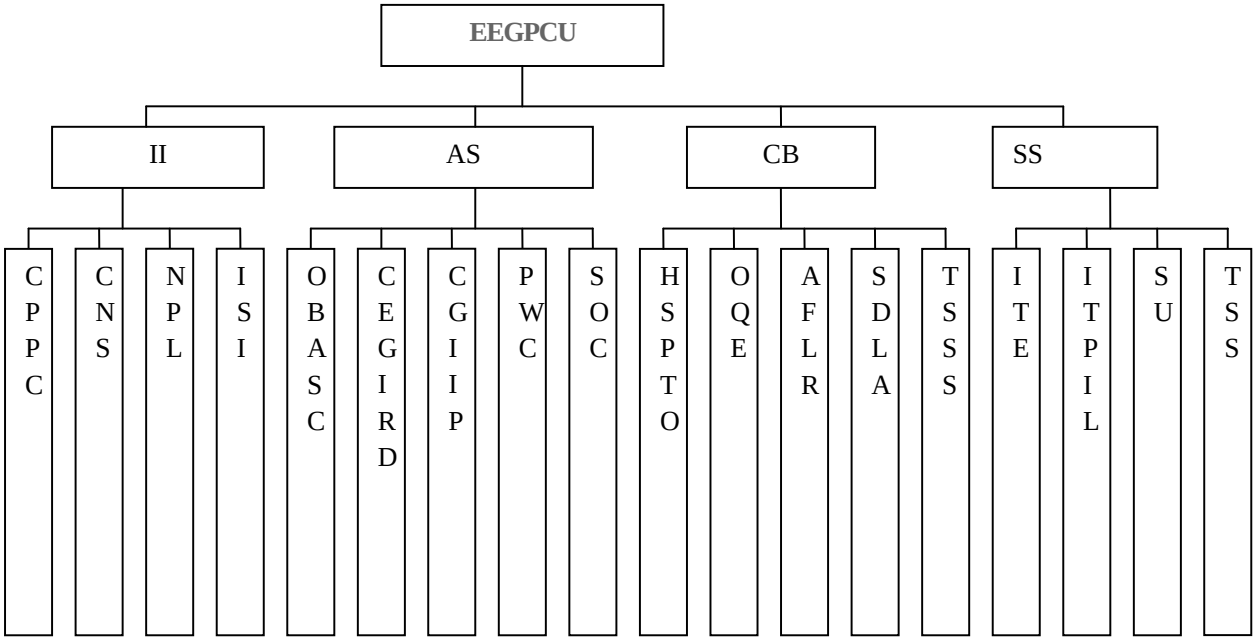
It consists of four secondary indexes, including Ideas and talent environment(ITE),Information technology planning and implementation level(ITPIL),Standard usage(SU),Technical support and security(TSS).

DETERMINE INDEX WEIGHT THROUGH ANALYTIC HIERARCHY PROCESS

Index weight is an important component of index system, which determines the importance of each index in the whole evaluation system, so it is of vital importance to determine scientific and reasonable weights in comprehensive evaluation. Analytic Hierarchy Process (APH) is adopted in this paper to determine the weight. AHP is a systematic and layering analysis method that combines qualitative and quantitative characteristics, and proposed by renowned American Operational Research Expert T. L. Satty, as well as other experts in the 1970s. The basic thinking of AHP is to decompose the factors relate with decisions into targets, standards, or proposals, on the basis of which to conduct qualitative and quantitative analysis[5,6].

Build Hierarchy Structure Model

The key of AHP lies in establishing hierarchy model. In order to solve modeling problems, T.L.Satty divided the factors included in the problems into several layers, which may be generally classified as the highest layer, the middle layer, and the lowest layer. According to the principle of AHP and the above mentioned analysis of nursing clinical teachers' comprehensive quality evaluation index system, we have obtained the hierarchy model of nursing clinical teachers' comprehensive quality evaluation, which is showed as Picture 1:



Picture 1 Hierarchical Model of Education E-government Performance in colleges and universities

Establish Judgment Matrix

After establishing hierarchy model, the importance of factors at each layer to that of the above layer should be determined, and the value should be marked and quantified, so as to construct the judgment matrix, which is a key step of AHP. In order to obtain the value of each factor in the matrix, experts should first compare the factors and then give a judgment value. Then, according to the nine-level scales shown in Table 1, the judgment result should be quantified, thus forming the judgment matrix.

Table 1 Table of Judgment Matrix Scale (obtain the intermediate value between two factors)

Index contrast between A and B	Equally important	Slightly important	Obviously important	Especially important	Extremely important	Slightly unimportant	Obviously unimportant	Especially unimportant	Extremely unimportant
Evaluation value of index A	1	3	5	7	9	1/3	1/5	1/7	1/9

Organize experts to conduct questionnaire survey by adopting the Delphi method, and we can obtain five judgment matrixes after collecting the expert questionnaire (for limited space, theses matrixes will not be listed out one by one).

Hierarchical Single Sorting

Single hierarchical arrangement is to determine the importance weight of each index at certain layer to that of the above layer. The most commonly used calculation methods include root, sum, eigenvalue method, and least square method. This paper adopts the sum method, the specific calculation steps are as follows:

(1) Normalize each column of the judgment matrix A , namely $\bar{b}_{ij}$

$$\bar{b}_{ij} = a_{ij} / \sum_{k=1}^{n} a_{kj}, i, j = 1,2,\cdots,n$$

(2) Calculate the sum of each row's factors for judgment matrix normalized each column, namely $\overline{w_i}$

$$\overline{w_i} = \sum_{j=1}^{n} \bar{b}_{ij}, i = 1,2,\cdots,n$$

(3) Normalize the vector $\overline{W} = \left(\overline{W_1}, \overline{W_2}, \cdots, \overline{W_n}\right)$

$$W_i = \frac{\overline{W_i}}{\sum_{j=1}^{n} \overline{W_j}}$$

Then, $W = (W_1, W_2, \cdots, W_n)^T$ is the eigenvector needs to be determined.

This eigenvector represents the influence degree of partial or all factors at this layer on certain factor of the above layer, namely the weighted value. These values are the results of single arrangement.

Consistency Checks

Consistency verification of the judgment matrix is needed to check whether the distribution of weight number that determined by the arrangement weight vector of $W = (W_1, W_2, \cdots, W_n)^T$ is reasonable.

(1) First, calculate the maximum characteristic root of judgment matrix, namely $\lambda_{\max}$

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i} = \frac{1}{n} \sum_{i=1}^{n} [(\sum_{j=1}^{n} a_{ij} \omega_j / \omega_i)]$$

Wherein, $(AW)_i$ denotes the ith factor of the vector AW.

(2) Calculate the deviation consistency indexr of judgment matrix, namely I_C

$$I_C = \sum_{i=1}^{n} a_i (I_C)_i = \frac{\lambda_{\max} - n}{n-1}$$

(3) Calculate themean random consistency index of judgment matrix, namely I_R

According to the judgment matrix of the 1-15 ranks, the RI values are respectively listed as the following table:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	0.58	0.89	1.12	1.26	1.36	1.41	1.46	1.49	1.52	1.54	1.56	1.58	1.59

(4) Then, calculate the random consistency ratio of judgment matrix, namely R_C

$$R_C = \frac{I_C}{I_R}$$

When R_C<0.10, the judgment matrix is regarded to possess satisfying consistency, otherwise it needs to adjust the judgment matrix, to provide it with satisfying consistency.

Therefore, we can obtain the following weight of primary index and secondary index:

Primary index weight: $\omega_1 = 0.25, \omega_2 = 0.25, \omega_3 = 0.25, \omega_4 = 0.25$

Secondary index weight:

$\omega_{11} = 0.250, \omega_{12} = 0.250, \omega_{13} = 0.250, \omega_{14} = 0.250$,

$\omega_{21} = 0.220, \omega_{22} = 0.220, \omega_{23} = 0.220, \omega_{24} = 0.220, \omega_{25} = 0.120$,

$\omega_{31} = 0.197, \omega_{32} = 0.202, \omega_{33} = 0.197, \omega_{34} = 0.202, \omega_{35} = 0.202$,

$\omega_{41} = 0.250, \omega_{42} = 0.250, \omega_{43} = 0.250, \omega_{44} = 0.250$

In this way, we can obtain a complete nursing clinical teachers' comprehensive quality evaluation index system, which is shown as Table 2.

Table 2 Education E-government Performance Comprehensive Evaluation Index System in Colleges and Universities

Primary Index		Secondary Index	
Index Item	Weight	Index Item	Weight
II	0.25	CPPC	0.250
		CNS	0.250
		NPL	0.250
		ISI	0.250
AS	0.25	OBASC	0.220
		CEGIRD	0.220
		CGIIP	0.220
		PWC	0.220
		SOC	0.120
CB	0.25	HSPTO	0.197
		OQE	0.202
		AFLR	0.197
		SDLA	0.202
		TSSS	0.202
SS	0.25	ITE	0.250
		ITPIL	0.250
		SU	0.250
		TSS	0.250

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