Research on Core Application Indicators of Educational Informatization in Colleges and Universities

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Abstract: As an important means to evaluate the development level of educational informatization in China, the index system of educational informatization development is a basic problem in the process of formulating educational informatization policies and studying development strategies. In order to guide the healthy and rapid development of informatization in colleges and universities, it is necessary to evaluate the level of informatization in colleges and universities accurately and reasonably. In this paper, through interviews and investigations of experts, the evaluation index of university informatization is constructed, and the weight of each index is determined by using expert scoring method and analytic hierarchy process, thus forming an effective evaluation index system of university informatization, and the connotation and evaluation criteria of each index are explained. It makes a useful exploration for building a comprehensive evaluation system of multiple indicators that comprehensively, objectively and accurately reflects the construction of educational informatization.

1. Introduction

The influence of informationization on higher education is profound and comprehensive, and it has become a common understanding and strategic choice for the development of education in all countries in the world to drive the modernization of higher education by educational informationization. The Outline of National Medium-and Long-Term Education Reform and Development Plan (2010-2020) (referred to as the Outline of Education Plan) lists “accelerating the process of education informatization” as an independent chapter, which highlights the importance and necessity of the development of education informatization in China. In order to standardize and guide the rapid and healthy development of informatization construction in colleges and universities, it is urgent to establish a set of scientific and complete evaluation index system and corresponding evaluation methods of informatization level in colleges and universities, so as to conduct reasonable evaluation of informatization construction in colleges and universities and guide their next practice [1].

The research on informatization in China started late in 1990s, and there are few related literatures. The existing research on informatization mainly focuses on the introduction of foreign informatization, the relationship between informatization and economic development, informatization and industrialization, the construction of enterprise informatization, and the measurement of social informatization level. Zhu Zhiting et al. [2] used the comparative analysis method of measure theory to construct the evaluation model; Li Yi et al. [3] used the sum-product method to measure the weight and study the importance of the main indicators; Yang Wenyu and others [4] gave a comprehensive description of the index system, analysis and evaluation, measurement methods and measurement forms; It is an important direction of China's current educational development to promote the overall educational reform and development with educational informationization, and university informationization is an important part of educational informationization [5]. Therefore, it is of great significance to carry out the evaluation of higher education informatization.

Considering the current situation and trend of informatization construction in colleges and universities at home and abroad, and combining with the practical experience of informatization construction in our university, this paper formulates the general idea of constructing the evaluation

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index system of informatization in colleges and universities, and puts forward an initial index system framework. This paper mainly discusses the construction of evaluation index system of university education websites in educational information resources.

2. Design of Evaluation Index System of Educational Informatization

2.1 Scientific Principle

The statistical evaluation index of educational informatization development level in China can be analyzed from two dimensions, including the specific development of educational informatization at all levels and the common development elements of educational informatization [6]. The basic data provided by this index system should be able to objectively and comprehensively evaluate the current situation, development level and development potential of educational informatization in colleges and universities, and analyze and diagnose the problems existing in the process of educational informatization construction and its application, so as to improve the quality of university informatization construction, avoid blindness and arbitrariness in the process of construction and application, and serve the formulation of relevant policies and plans.

2.2 Principle of Easy Collection and Statistics

For the design of specific indicators, it is necessary to consider the convenience of data collection of the indicators, so as to make classified statistics according to various educational management institutions and schools at all levels, and to link up with existing relevant statistical data as much as possible. Moreover, the selected indicators should be linked with the existing data of colleges and universities as far as possible, and the necessary new indicators should be clearly defined to facilitate data collection. At the same time, when designing the index system, we should also consider that educational informationization is a dynamic process, and some indexes are advancing with the times, so we should leave some room to adapt to their changing trends and development trends.

2.3 Dynamic Principle

With the change of environment and the development of technology and practice, the informationization scheme of colleges and universities should be improved accordingly. Therefore, the evaluation index system should reflect the changes of colleges and universities in the process of informationization and make timely adjustments.

2.4 Principle of Sustainable Development

The construction of information-based campus is a complex system, which requires not only the participation and communication of various departments within universities, but also the cooperation between universities, and also the intervention and efforts of enterprises. All efforts should be able to achieve accumulation and ensure sustainable development in the future, which is also consistent with the dynamic principle.

3. Design Process of Evaluation Index System of Educational Informationization

3.1 Selection of Evaluation Index

The cost of education informatization refers to the value sacrifice that should occur or actually occur in order to promote education reform and realize informatization education. This includes not only monetary costs, but also non-monetary costs paid by faculty and students who participate in educational informationization. The 21st century students must have basic information literacy,

including making effective use of ICT to research and obtain information, critically evaluating information, and creatively processing and applying information [7]. According to the principles and policies of national informatization construction, the index weights and statistical methods are determined to reflect the development trend of higher education informatization, so that the whole higher education informatization can conform to the development trend and achieve a successful development.

Combined with the existing research results of social informatization, according to the basic principles of evaluation system, and referring to the experience of university informatization evaluation system in various countries, combined with the actual investigation, this paper puts forward an operable and targeted system. According to the university information system structure proposed in this paper, combined with the general methods and contents of measuring and evaluating university information level, the author thinks that the evaluation index system of university information system can be composed of the following aspects, as shown in Table 1

Table 1 Composition Scheme Of Evaluation Index System of Informatization Level in Colleges and Universities

Primary index	Secondary index
Strategic position	X_1 Annual operation and maintenance investment/10,000 yuan
	X_2 The ratio of information investment to the total investment of the school in the past three years/%
	X_3 Growth rate of funds/%
Infrastructure	X_4 Personal computer ownership rate/%
	X_5 Multimedia classroom ratio/%
	X_6 Campus network coverage rate/%
Application status	X_7 The number of courses on the network-aided instruction platform
	X_8 The proportion of courses using multimedia teaching in the latest academic year to the total courses/%
	X_9 Total number of students taking online courses in the latest academic year
	X_{10} Average daily visits to school homepage
Information resources	X_{11} The number of various literature databases that the library can provide
	X_{12} Daily visits to library electronic resources
	X_{13} Daily downloads of library electronic resources
Human resources	X_{14} The number of people who formally participated in the informationization training organized by the school in the last school year
	X_{15} Scale of information construction department
	X_{16} The scale of technical support and operation and maintenance team in the school
Organization and management	X_{17} The degree of applying industry standards of the Ministry of Education in informatization construction
	X_{18} Implement clear information security related specifications

The systematicness and usability of network resources are poor, the structure is loose, the resources are lack of authority, and few valuable materials can be obtained by learners and educators on the Internet. It is a quantitative distribution of the importance of different aspects of the informatization level of colleges and universities, and treats the role of each evaluation index in the overall evaluation differently. The weights corresponding to the informatization evaluation

index system of colleges and universities constitute the weight system of informatization evaluation index of colleges and universities [8].

3.2 Determination of Indexes At All Levels and Their Weights

The design of the core index system of educational informatization must be based on the macro-strategic perspective, which not only fully investigates the informatization development needs and evolution trends of all levels of education, but also fully considers the relevant national education informatization policies and government documents. In general, the judgment matrix is not required to have this property, such as the maintenance cost of information facilities, the training cost of campus personnel, the cost of construction, technical support and operation and maintenance team, the scale of information management department, and the operation cost of Internet. Other management information systems include scientific research, enrollment and employment, library, computer room, campus card and other management information systems.

Experts compare the relative importance of the six first-level indicators in pairs, and judge them with the judgment scale to determine the matrix elements. See table 2 for the definition of judgment scale:

Table 2 Judgment Scale Definition Table

Judgment scale	Definition
1	C_i has the same effect as C_j.
3	C_i has a slightly stronger influence than C_j.
5	C_i has a stronger influence than C_j.
7	The influence of C_i is obviously stronger than that of C_j
9	C_i is absolutely stronger than C_j.
2,4 , 6,8	The ratio of the influence of C_i to C_j is between the two adjacent levels
1,1/2 ... 1/9	The ratio of the influence of C_i to C_j is the inverse of a_{ij} mentioned above

Taking “problem solving” as the starting point, the evaluation index is designed in accordance with the law of information construction. The content of most educational websites is still based on text, and the links between information units are not well reflected. Considering the high permeability of informatization, the fuzzy comprehensive evaluation method can be used to comprehensively evaluate the current situation and level of informatization in colleges and universities, and provide specific guidance for further improvement of informatization construction. Therefore, the evaluation index system of informatization level in colleges and universities must be able to examine the realization of the strategic goal of informatization in colleges and universities.

3.3 Evaluation Model

The informatization construction of college education has a profound impact on college education, which promotes the transformation of teachers' teaching ideas and teaching methods, improves teaching quality, improves the efficiency of education management, reduces the cost of education management and promotes the development of scientific research in colleges and universities. The application of educational information has been paid more and more attention, which is closely related to the actual needs of our country. In the process of processing, the indexes whose mean value is in the last place and population standard deviation is obviously higher than other indexes are eliminated, and the indexes with higher mean value and lower population standard deviation are selected as the final indexes. Therefore, it is necessary for evaluators to choose evaluation methods flexibly according to the above evaluation criteria, and sometimes even to adopt a combination of various methods, so as to give full play to the advantages of a certain method and

restrain the disadvantages of a certain method.

Suppose there are m samples of colleges and universities to be evaluated, and the evaluation indexes are n. In the actual evaluation, n representative indexes of informatization construction of colleges and universities are selected and recorded as $x_j\left(j=1,2,\cdots n\right)$ respectively, thus obtaining the original data matrix as follows:

$$X=\left(x_{ij}\right)_{m\times n} \quad (1)$$

If the standardized data matrix is $Y=\left(y_{ij}\right)_{m\times n}$, the standardized transformation formula is

$$y_{ij}=\frac{x_{ij}-\bar{x}_j}{s_j} \qquad \left(i=1,2,\cdots,m;\ j=1,2,\cdots,n\right) \quad (2)$$

Among them, $\bar{x}_j, s_j$ are the sample mean and standard deviation of the j th index respectively, i.e.

$$\bar{x}_j=\frac{\sum_{i=1}^{m}x_{ij}}{m} \quad s_j=\sqrt{\frac{1}{m-1}\sum_{i=1}^{m}\left(x_{ij}-\bar{x}_j\right)^2} \quad (3)$$

As an educational website of a university, we should pay more attention to the effectiveness of its website and whether it can produce a new educational model. In this way, each evaluation index should play its due role, and at the same time, the weight determination should conform to the principle of combining democracy with centralization. On the one hand, the school has an objective understanding and evaluation of the informatization level of the school by using the evaluation index system, and provides theoretical guidance and basis for the informatization construction of the school [9]. On the other hand, the higher authorities evaluate the informationization level of each school and assess the informationization work of the school.

4. Analysis of Evaluation Results

From the perspective of information technology integration, it has gone through multimedia-assisted teaching, information technology and curriculum integration, that is, from learning information technology to using information technology to learning and then to deep integration of technology and learning; At the same time, it also brings about changes in students' learning environment, learning ability and learning effect, and promotes the improvement of students' overall quality. Because the average value indicates how important experts think they are, while the population standard deviation value indicates whether there is a big difference between experts' opinions on whether they are important or not. The evaluation index system can quantitatively give reasonable results to the informationization level of colleges and universities, and can comprehensively and intuitively understand the informationization status of colleges and universities, and guide the informationization construction and application conveniently.

It can be seen from Table 3 that the Spearman correlation coefficient between the comprehensive score of cost and the comprehensive score of benefit is 0.557, and its significance test result (bilateral) is 0.022, which is less than 0.05, indicating that there is a significant correlation between cost and benefit, and the cost input of educational informationization will affect the benefit of educational informationization. The relationship between cost input and benefit output should be considered comprehensively in the evaluation of educational informatization, so as to make a comprehensive evaluation of it.

Table 3 Correlation between Cost and Benefit of Educational Informatization in 10 Universities

			Comprehensive cost score F	Comprehensive benefit score F
RHO correlation coefficient of	Comprehensive cost score F	Correlation coefficient	1.1041	.557*

Spearman		Sig. (bilateral)	.0001	.022
		N	10	10
	Comprehensive benefit score F	Correlation coefficient	.517*	1.1041
		Sig. (bilateral)	.022	.0001
		N	10	10

The construction of application index is the core of the index system of educational informatization. After the evaluation work comes to an end, the collected data should be saved in time to prepare for the next stage of analysis. While continuing to do a good job in infrastructure construction and the training and introduction of information talents, we should strengthen the construction of information resources and information application, and attach importance to the construction of follow-up supporting application software, network teaching system and educational resources. Visits can be obtained through website technology or other technical means; Linked by other websites, including linked websites, webpages and the number involved; Only by combining information technology with the process of education and teaching, the process of transforming education and teaching with information technology is educational informationization.

5. Conclusions

This paper puts forward a set of educational informatization index system from a macro perspective, but the follow-up needs more relevant empirical research, such as collecting accurate and reliable empirical data from the front line of education in China. The specific interpretation method of indicators at all levels, projecting the multidimensional vectors of each evaluation index to the same vector, can not only eliminate the influence of overlapping information between indicators, but also effectively avoid the inevitable human factors in determining the index weight by AHP and establishing a comprehensive fuzzy hierarchical evaluation model. By using this method, we can not only see the general level of the informatization level of the university, but also get a specific score, which is convenient for horizontal comparison among universities and vertical comparison among individual universities.

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