Research on Measurement Methods of China's Equilibrium Development of Compulsory Education

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ABSTRACT: Based on the definition of equilibrium development of compulsory education, a conceptual model of equilibrium development of compulsory education has been put forward, which includes balanced education opportunities, balanced allocation of education resources and balanced educational quality. In terms of popularization, consolidation and equality of opportunities; planning layout and school conditions; teaching staff and the quality of teachers; quality education and the development of the students as well as education management and funds support, an indication system of the measurement of equilibrium development of compulsory education is constructed and a measure model of equilibrium development of compulsory education has been built based on the MEM-GAHP method. The feasibility of the method has been testified through cases.

KEYWORD: Equilibrium development of compulsory education; Equilibrium measure; Indication system; Matter-elements model; Group decision analytic hierarchy process

1 INTRUCTION

The equilibrium development of compulsory education has emerged since the 21st century which has drawn wide attention from the theoretical and academic fields. [1] Having fully realized the significance and function of education, China's government attached great importance to the equilibrium development of compulsory education for years and put forward the forward-looking strategy of the equilibrium development of compulsory education timely after reaching a certain stage of social development. The National Outline for Medium and Long Term Education Reform and Development (2010-2020) holds that equality of opportunities is the key to gain equal access to education and the fundamental measure to promote equality of opportunities is to allocate educational resources rationally. It follows that balanced allocation of educational resources plays an important role in achieving the equal access to education. According to the data of China's resources allocation of compulsory education over the past years, although the regional differences and urban-rural differences of compulsory education have been constantly decreasing, the differences still exist, among which there is a wide gap between different regions and between urban and rural areas in the allocation of hardware like teaching staff, educational fund and teaching facilities as well as software.

As a critical part of educational system reform, to achieve the equilibrium development of compulsory education is in relation to the future development of a country and nation and has a bearing on the equality of human rights.[2] Thus, to achieve the equilibrium development of compulsory education has always been the goal of Chinese government. The policy-making calls for the support of status quo and hence measurement method of China's equilibrium development of compulsory education is an urgent task to be fulfilled.

2 ESTABLISHMENT OF CONCEPTUAL MODEL OF EQUILIBRIUM DEVELOPMENT OF COMPULSORY EDUCATION

The equilibrium of education, of its very nature, refers to "the process to promote the equilibrium education by virtue of structure optimization, resources sharing, efficiency increase and institutional guarantee when the local educational administrative departments and schools are faced with the lack or relative scarcity of educational resources." Judging from the current situation of compulsory education, the equilibrium development of compulsory education has embarked on a path of

connotation development and by stressing their own strength it will achieve the equilibrium of education. China's compulsory education encourages to act according to one's circumstances, to optimize the allocation of educational resources and to optimize the allocation of educational resources which contributes to the resolution of limited resource and insufficient demand and acts as a benign cycle of equilibrium development process.

Based on the above-mentioned discussion, the equilibrium development of compulsory education can be defined as: it refers to comprehensive equilibrium degree in compulsory education, including educational factors like education opportunities, allocation of educational resources and the quality of education together with the spatial and temporal factors. The equilibrium development of compulsory education is a comprehensive measure index, involving equilibrium education opportunities, equilibrium allocation of educational resources and education quality.[3]

The equilibrium of education opportunities refers to the equilibrium in the popularization of compulsory education among school-age children, the proportion of school choice students in public school, the degree of perfection of the financial assistance system, educational opportunities for students and opportunities to enter high-quality high school in the compulsory education; The equilibrium of the allocation of educational resources refers to the equilibrium in school layout, school scale, high-quality educational resources, teaching staff, the quality of teachers and educational fund. The equilibrium of education quality refers to the equilibrium in quality education and the comprehensive qualities of students in the compulsory education.

3 THE ESTABLISHMENT OF MEASURE SYSTEM OF EQUILIBRIUM DEVELOPMENT OF COMPULSORY EDUCATION

3.1 *The Establishment of the Measure Indication System of Equilibrium Development of Compulsory Education*

It can be seen from the definition of the equilibrium development of compulsory education and the analysis of conceptual model that the equilibrium development of compulsory education manifests itself in equilibrium education opportunities, equilibrium allocation of educational resources and education quality. [4] Hence, in the process of constructing the measure indication system of equilibrium development of compulsory education, specific indicators should be found out to represent each of the three aspects and after the analysis of these indicators, the system will be constructed.

The measure indication system of equilibrium development of compulsory education is shown in Table 1.

3.2 *The Establishment of the Measure Model of Equilibrium Development of Compulsory Education*

The measure indication system of equilibrium development of compulsory education constructed is a complex system involving a great number of indicators and there is great uncertainty and incompatibility among indicators. Furthermore, in the measure indication system of equilibrium development of compulsory education, most indicators cannot be determined by digital forms; hence, the characteristic value of the measure indication of the equilibrium development of compulsory education can only be determined after the judgements from experts. In addition, the measure indication of the equilibrium development of compulsory education itself contains multiple levels and the importance of each indicator is different in the indication system, thus some certain measures shall be taken to determine the weights of the indication system. Taking the above-mentioned requirements into consideration, this paper is designed to make use of MEM and GAHP to construct the measure model of equilibrium development of compulsory education.

The establishment steps of the measure model of equilibrium development of compulsory education based on MEM-GAHP model is as follows: [5][6]

Step1: Classical domain and extensional domain determination

This paper holds that the equilibrium of compulsory education development can be divided into five levels, namely, high, relatively high, general, relatively low and low. Thus, the measure indicators of equilibrium development of compulsory education can be divided in order from lowest to highest into five classes, namely first, second, third, fourth and fifth class among which the first indicator stands for low, the second relatively low, the third general, the fourth relatively high and the fifth high. Additionally, 100 stands for the highest level of the equilibrium of compulsory education development while 0 is regarded as the lowest level. The value of each measure indication ranges between [0, 100], among which [0-20) matches the first indicator; [20-40) matches the second indicator; [40-60) matches the third indicator; [60-80）matches the fourth indicator and [80-100] matches the fifth indicator.

Table 1 Indication system of the measure of equilibrium development of compulsory education

Target layer	First Indicator	Second Indicator
The measurement of equilibrium development of compulsory education	Popularization, consolidation and equality of opportunities X_1	The consolidation rate of compulsory education X_{11}
		The proportion of public school choice students X_{12}
		Disabled children enrollment rate X_{13}
		Public school attendance rates of children of migrant workers X_{14}
		The equilibrium of placement X_{15}
		Quotas distribution equilibrium of four-star high schools X_{16}
	Planning layout and school conditions X_2	Layout of compulsory education school X_{21}
		Running equilibrium of standard classes X_{22}
		Average school conditions equilibrium X_{23}
		Sharing equilibrium of education and teaching resources X_{24}
		Equilibrium long-term management of teaching premises, facilities and equipment X_{25}
	Teaching staff and the quality of teachers X_3	The equilibrium ratio of teachers and students X_{31}
		The periodical flow working conditions of the principal X_{32}
		The flow working conditions of excellent teachers X_{33}
		The equilibrium of teacher training and scientific research X_{34}
		The equilibrium of backbone teachers distribution X_{35}
		The equilibrium of teacher qualifications distribution X_{36}
	Quality education and the development of the students X_4	The equilibrium of school-based curriculum development X_{41}
		The equilibrium of the quality of compulsory education X_{42}
		The equilibrium of the management level of the course X_{43}
		The equilibrium of moral education and art education activities X_{44}
		The good rate equilibrium of students' comprehensive quality evaluation X_{45}
		The good rate equilibrium of the quality of school education X_{46}
		The equilibrium of students' satisfaction X_{47}
		The equilibrium of parents' satisfaction X_{48}
		Social satisfaction equilibrium X_{49}
	Education management and funds support X_5	County government's efforts to the equilibrium development of education X_{51}
		Growth in financial allocations for the compulsory education X_{52}
		Rationality of educational fund distribution X_{53}
		Performance evaluation system of the use of educational fund X_{54}
		Rationality of school peripheral environment management X_{55}
		Public service system of compulsory education at the county level X_{56}
		School's satisfaction level to education management by county government X_{57}
		Society's satisfaction level to education management by county government X_{58}

STEP2: Weight determination of the index system of data mining tools competence evaluation

GAHP will be used to determine the weight of data mining tools competence evaluation index system. Suppose the weight distribution of first grade evaluation indicator X_i is a_i ($i=1,2,\ldots,5$), weight-vector of first grade indicator $A=(a_1,a_2...,a_5)$, and $a_i \geq 0$, $\sum_{i=1}^{5} a_i = 1$; Suppose the weight distribution of second grade evaluation indicator X_{is} is a_{is} ($i=1,2,\ldots,5$; $s=1,2,\ldots, n_i$), weight-vector of each second grade indicator $A_i=(a_{i1},a_{i2},...,a_{in})$, and $a_{is} \geq 0$, $\sum_{s=1}^{n_i} a_{is} = 1$.

STEP3: Determining matter elements for evaluation

In the specific process of measurement of equilibrium development of compulsory education,

it shall be carried out by experts in accordance with above index system and evaluation standard, meanwhile, average value of all the experts shall be assigned as the quantity value of this indicator X_{is}. In accordance with the listed index system, quantity of matter elements for evaluation m=6. Suppose object for evaluation is P_m (m=0,1,…,5), each result is represented by matter element R_m and named as matter element for evaluation.

STEP4: Determining the association with each grade *j* of indicators of matter-element for evaluation

Suppose:

$$K_j(x_i)=\begin{cases}\dfrac{\rho(x_i,x_{0ji})}{\rho(x_i,\ x_{pi})-\rho(x_i,x_{0ji})}, & \rho(x_i,\ x_{pi})-\rho(x_i,x_{0ji})\neq 0\\ -\rho(x_i,x_{0ji})-1, & \rho(x_i,\ x_{pi})-\rho(x_i,x_{0ji})=0\end{cases} \quad (1)$$

Among which,

$$\rho(x_i,x_{0ji})=\left|x_i-\frac{1}{2}(a_{0ji}+b_{0ji})\right|-\frac{1}{2}(b_{0ji}-a_{0ji}) \quad (2)$$

$$\rho(x_i,x_{pi})=\left|x_i-\frac{1}{2}(a_{pi}+b_{pi})\right|-\frac{1}{2}(b_{pi}-a_{pi}) \quad (3)$$

b_{0ji} ——Upper limit value of classical domain;

a_{0ji} ——Lower limit value of classical domain;

b_{pi} ——Upper limit value of extensional domain;

a_{pi} ——Lower limit value of extensional domain.

STEP5: Calculating the association with each grade *j* of matter P_m for evaluation

If the weight coefficient of Indicator X_i is a_i, while $\sum_{i=1}^{n} a_i = 1$, then

$$K_j(p)=\sum_{i=1}^{n} a_i K_j(x_i) \quad (4)$$

In the formula, $K_j(P)$ refers to the combination value of the association with each grade of indicators of matter-element for evaluation in consideration of index weight. It is not only the association model about grade *j* of each evaluation module, but also the association with each grade *j* of entire matters for evaluation.

STEP6: Grade assessment

If $K_{jo}(P)=\max_{j\in 1,2,\ldots,m} K_j(P)$, P_m would be evaluated as belonging to grade j_0.

4 CONCLUSION

Educates' roughly equal access to education is the goal countries all seeking after. As an indispensable part of national education system, compulsory education plays a fundamental role in improving the overall national quality. Local governments at the county level, as the management body of compulsory education, shall guarantee the equilibrium development of compulsory education within the scope of jurisdiction. Based on this, the evaluation system targeted at the county government helps improve their enthusiasm of promoting the equilibrium development of compulsory education and plays a positive role in guaranteeing the proper distribution of educational resources.

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