Method and Application of Equilibrium Measurement of Compulsory Education Resource Allocation Based on the Gini Coefficient *

Xiaoyan Xiong [1]

Hohai University

Juqin Shen [2]

Hohai University

Jian Chen [3]

Nanjing Forestry University

Abstract

Based on the reality of the Chinese government's promotion of the integration of urban and rural compulsory education, this paper proposes the concept of the compulsory education resource allocation Gini coefficient and comprehensive balance of compulsory education resource allocation and defined that the balance of compulsory education resource allocation can be reflected through the comprehensive equilibrium of compulsory education resource allocation. This paper proposes a compulsory education resource allocation balance measurement index system of two parts, which are a mandatory indicator system and a control index system, with the former being the minimum standard that must be met. Based on the PSR theory, a control index system consisting of 3 dimensions and 12 indicators is constructed from three aspects: pressure, state, and corresponding dimensions. This paper proposes a method of measuring the Gini coefficient of compulsory education resource allocation and the allocation balance of compulsory education resources, and verifying the feasibility of theoretical research through cases.

Keywords

Compulsory Education Resource Balanced Allocation • Gini Coefficient • Comprehensive Equilibrium • Indicator System • Measurement Method

The report of the 19th National Congress of the Communist Party of China stated: "to promote the integration of urban and rural compulsory education, attach great importance to rural compulsory education, and run preschool education, special education, and online education." On March 15, 2018, Premier Li Keqiang's "Government Work Report" clearly stated that to "develop fair and quality education, promote the integrated development of urban and rural compulsory education, and education investment will continue to lean toward difficult areas and weak links" was necessary. This statement shows that China will continue to promote the balanced allocation of compulsory education resources in the coming period. After more than ten years of hard work, China has achieved the balanced allocation of compulsory education resources and some regions have basically achieved a balanced development of compulsory education.

Developing fair and quality education, as well as giving everyone equal opportunities to change their own destiny and achieve their dreams through education, is one of the important ways for the Chinese government to improve security and people's livelihood. The balanced allocation of educational resources is an important means of achieving a balanced development of compulsory education. An important task of research in this field is to clarify and quantify the current state of the balanced allocation of compulsory education resources in various regions. This is done by clarifying the criteria for the balanced allocation of compulsory education resources and identifying the equilibrium configuration of compulsory education resources. The problem and the proposed improvement strategy provide effective support, which is also related to the measurement of the balance of resource allocation in compulsory education. Through measurement work, it can reflect the degree of the balance of compulsory education resources allocation, the state and the level of compulsory education in each region, the existing law of temporal and spatial changes, and provide a basis for finding a solution to the problem of the balanced allocation of compulsory education resources. Since the balance of compulsory education resource allocation itself involves many dimensions, the establishment of a set of scientific and systematic indicator systems and adopt a comprehensive evaluation method to measure the balance of compulsory education resource allocation in each region is necessary.

Literature review

In recent years, research on the measurement of the balance of resource allocation in compulsory education has been based on the perspective of educational equity. The indicators of the existing research are mainly a series of basic indicators of the comprehensive education level and school conditions (including the teaching staff, school conditions, and teaching equipment) and education funding allocation for the entire nation.

UNESCO integrates indicators, such as education supply, education needs, enrollment and participation, internal education efficiency, and education output, into the World Education Development Indicators System. The Education Development Index (EDI) proposed by the Organization for Economic Co-operation and Development (OECD) also classifies the factors affecting the balanced development of education in the system that affects development indicators.

The early indicators were built mainly on input and output theory. Johostone proposed the idea of "educational input–process–outcome". Education input refers to the input resources, including both the available educational resources and the group's preference for education, of the education system. The educational process refers to the operation mechanism that transforms educational resources into educational outcomes and is closely related to the educational structure and the allocation of educational resources. Educational output refers to the contribution of the education system. Johostone believes that past political, economic, and other system architectures affect the input, process, and output of education, i.e., the development framework of education, which in turn, will affect the future political, social and economic system architectures. The RAND Corporation has also adopted the "input-process" model to build an indicator system, in which the input is the allocation of educational resources. Under this model, educational input includes not only the

financial system and other resources but also resources such as the impact of education on the quality and teaching backgrounds of students (Ryan, 2004).

The existing research focuses on the investment of financial power in education and the distribution of educational resources. These aspects have achieved certain results but there are still several problems (Card & Krueger, 1996; Pritchett & Fulmer, 1997; Hanushek, 1997; Fortune, 1993; Hodas, 1993; Levin, 1993; Colbert, Reuven & Levary, 2000; Breu & Raba, 1994; Izadi, Johnes, Oskrochi & Crouchley, 2002): (1) The research basically takes compulsory education as the object, which is more comprehensive, but it also results in the lack of research on the measurement index system and method of compulsory education resource allocation balance; (2) A relatively effective evaluation standard has not been established for the balance of compulsory education resource allocation.

This paper proposes the Gini coefficient as the foundation for a compulsory education resource allocation balance standard and a measurement index system, as well as the concept of comprehensive equilibrium of compulsory education resource allocation, to provide effective support for the development of the measurement of compulsory education resources balanced allocation.

Standard and Index System Based on Gini Coefficient

Proposal of Gini Coefficient and Concept of Integrated Equilibrium in Compulsory Education Resource Allocation
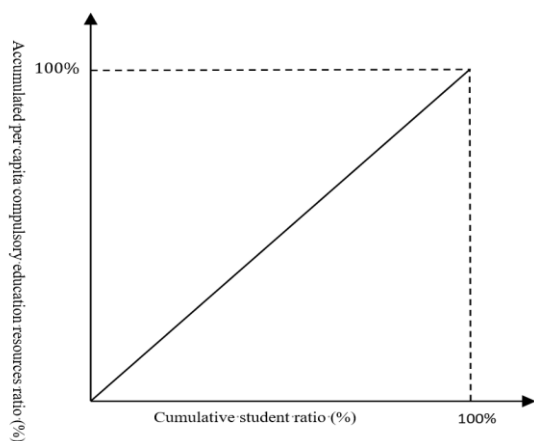

Figure 1. Relationship between cumulative student ratio and cumulative ratio of students' compulsory education resources under completely balanced compulsory education resources allocation

The Chinese government is currently evaluating the system of the balanced development of compulsory education, including compulsory education resources, mainly by examining the teaching and auxiliary housing area per student, sport stadium area per student, teaching equipment value per student, number of computers per 100 students, number of books per student, ratio of teachers to students, number of teachers above the prescribed number of teachers, number of teachers with intermediate and above-professional skills, and the difference coefficient between primary and junior high school being less than or equal to 0.65 and 0.55, respectively. All of these factors are the basis for evaluating whether to pass the balanced development of compulsory education. In this way, in the initial stage of the balanced development of compulsory education, judging effectively whether the compulsory education in each region is balanced or not and make the corresponding judgments is possible. With the effective implementation of China's balanced development of

compulsory education, the balanced development of compulsory education has been basically implemented in all regions, especially in developed regions. Therefore, in the subsequent stage, simply judging if the compulsory education system is balanced cannot meet the requirements of education management work any longer or provide support to the government's promotion of the formulation of the policies relevant to the balanced development of compulsory education. Rethinking the defined criteria of the balanced allocation of compulsory education resources is necessary in order to adapt better to the need of the government to promote the balanced allocation of compulsory education resources under the new situation.

The main indicators for examining the resource allocation of compulsory education are based on the number of resources occupied by the students (Richards & Vining, 2014). Moreover, for a region, if the allocation of compulsory education resources is completely balanced, the amount of resources occupied should completely meet the quantity requirement of the students. If we represent such content in a two-dimensional coordinate system, the abscissa represents the cumulative proportion of accumulated students (grouped according to the average compulsory education resources from low to high) and the ordinate represents the accumulated per capita compulsory education resources proportion. In this coordinate system, when the compulsory education resource allocation is completely balanced, it should reflect a straight line with a slope of 1 passing through the origin (see Figure 1).

Figure 1 reflects the relationship between the cumulative student ratio and the proportion of accumulated compulsory education resources per student in a state of full equilibrium of compulsory education resources allocation. This is an ideal state. In fact, because the state of compulsory education resources is completely balanced, it is impossible to achieve. Therefore, the relationship between the actual cumulative number of students and the cumulative number of compulsory education resources should be a curve below the line shown in Figure 1 (see Figure 2).
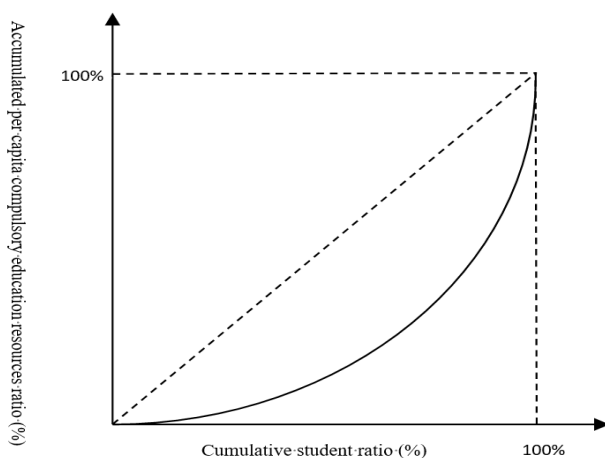
Figure 2. Relationship between actual cumulative student ratio and cumulative ratio of students' compulsory education resources under completely balanced compulsory education resources allocation

In fact, this has the same meaning as the Lorentz curve. To effectively measure the fairness of income distribution, i.e., the gap between the rich and poor, of a country or region, in 1943, American economist, Albert Otto Hirschman, proposed the Gini coefficient (G), which is based on the interface formed by the Lorenz curve. In Figure 3, the area between the actual income distribution curve and the income distribution absolute equality curve (i.e., the line passing through the origin with a slope of 1) is A while the actual income distribution curve is B. The Gini coefficient can be expressed as A / (A + B).

The smaller the Gini coefficient, the more balanced is the income distribution, whereas the larger the coefficient, the more uneven is the distribution, for which the coefficient ranges from 0-1.
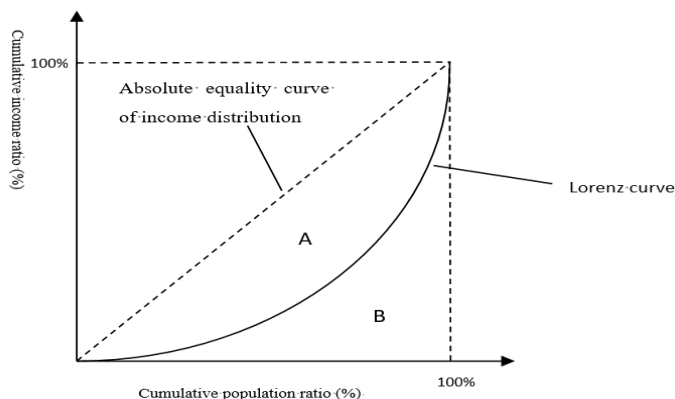
Figure 3. Gini coefficient calculation diagram

In view of the similarity between the balanced allocation of compulsory education resources and the national income distribution, the calculation method and content of the Gini coefficient can be used to design a corresponding method system to measure the balanced allocation of compulsory education resources. The relevant research has been conducted on the use of the Gini coefficient to measure the balanced development of education.

Using the concept and connotation of the Gini coefficient as a reference, this study proposes the concept of the Gini coefficient of compulsory education resource allocation and the comprehensive equilibrium of compulsory education resource allocation for using multiple indicators to measure the degree of the balanced allocation of compulsory education resources. By using one of the compulsory education resources to allocate balance indicators, the coefficient of the relationship between the calculated cumulative student ratio and the cumulative ratio of compulsory education resources is called the Gini coefficient of compulsory education resource allocation.

The concept of the comprehensive equilibrium of compulsory education resource allocation means that the balance of compulsory education resource allocation can be measured by multiple indicators. Each index has different weights for reflecting the balance of compulsory education resource allocation (Plank & Davis, 2010). The separate Gini coefficient of compulsory education resource allocation reflected by each index, combined with the weights of different indicators, forms the overall measure of the allocation of compulsory education resources, which is the comprehensive balance of compulsory education resources allocation in a certain region.

Defining criteria

Since the comprehensive equilibrium of the compulsory education resources equilibrium allocation is based on the calculation principle of the Gini coefficient, when using the comprehensive balance of compulsory education resource allocation to measure the balance of compulsory education resource allocation, the relevant definition criteria refer to the internationally accepted Gini coefficient standard.

Considering the important role of the balanced allocation of compulsory education resources in the balanced development of compulsory education when the resource allocation balance measurement is specifically being conducted, the relevant indicators should be divided into two categories: mandatory and control indicators. The former are the conditions that all schools should have. If any school does not meet the conditions, then the

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allocation of compulsory education resources in the region is not balanced. The control indicators can have some flexibility. As long as the indicators are within the controllable range, the allocation of compulsory education resources in a region can be considered to have a certain balance.

Based on the Gini coefficient, the comprehensive equilibrium of compulsory education resource allocation is used as the basis for judging and proposing the definition criteria of resource allocation in the compulsory education stage, as shown in Table 1.

Table 1
Compulsory education resource allocation definition standard

Level of compulsory education equilibrium allocation	Meaning of level	The range of value of comprehensive equilibrium of compulsory education equilibrium allocation
Level 1	Absolute equilibrium	<0.2
Level 2	Comparative equilibrium	0.2-0.3
Level 3	Relative equilibrium	0.3-0.4
Level 4	Relative disequilibrium	0.4-0.5
Level 5	Equilibrium	≥0.5

Construction of Measurement Index System

For the definition criteria of compulsory education resource allocation, this paper proposes that when the compulsory education resource allocation balance measure is made, the relevant indicators should be set as mandatory and control indicators. The former are the conditions that all schools should have. If any school does not meet the conditions, then the allocation of compulsory education resources in the region is not balanced. The control indicators can have some flexibility. As long as the indicators are within the controllable range, the allocation of compulsory education resources in a region can be considered to have a certain balance (Dollman, 2018).

On the basis of these ideas, in the specific setting of the index system, first of all, the principle of constructing the measurement index system of the compulsory education resource allocation balance should be clarified. The mandatory index for the measurement of the balance of compulsory education resource allocation should be established and the mandatory scope of the mandatory index should be clarified. Second, the concept of balanced allocation of compulsory education resources and the balance of compulsory education resource allocation should be combined. Following the theory of "stress-state-response" (PSR), a control index system for measuring the balance of compulsory education resource allocation should be constructed. Finally, the specific connotation of each indicator and the method for determining the characteristic value of the indicator should be clarified.

The compulsory education resource allocation balance measurement index system is divided into the two categories of mandatory indicators and control indicators. Therefore, constructing separate for these two types of indicator systems is necessary.

Mandatory indicators

Mandatory indicators are conditions that all schools should have. If any school does not meet the conditions, then this region is considered unbalanced in the allocation of compulsory education resources.

Compulsory education resources in the narrow sense refer to a general term for education-related material resources that are necessary to ensure the smooth realization of the goal of compulsory education, including

educational facilities, educational assets, and teaching staff. Therefore, for the allocation of compulsory education resources, the education resources should first be able to meet the basic needs of compulsory education. If the basic conditions, such as educational facilities, educational assets, and teaching staff, cannot meet the requirements, then they cannot be considered to achieve the optimal allocation of compulsory education resources.

Specifically, in the compulsory education resource allocation balance measurement index system, the mandatory indicators mainly include:

a. No dangerous buildings;

b. No obvious security risks;

c. The actual number of faculty and staff should not be less than 90% of the total amount; and

d. School assets do not match the reality.

If there are any schools in the compulsory education stage in a certain area that do not meet any of the above four mandatory indicators, the allocation of compulsory education resources in that area is considered to be uneven.

Control indicators

The control indicators can have a certain margin of flexibility as long as they are within the controllable range. We can consider this region's compulsory education resource allocation to have a certain balance index.

The control indicators for the measurement of the balance of compulsory education resources allocation mainly reflect the indicators that can have a certain margin of flexibility. The balance of resource allocation in compulsory education is a comprehensive reflection of both results and behaviors. Therefore, when evaluating the balance of compulsory education resources allocation, reflecting on the aspects of results and behaviors is also necessary. Moreover, in terms of the balance of compulsory education resource allocation, the schools will be subject to the pressure of student participation in activities, the time of schooling, and the efforts of the teachers, thereby affecting the state of educational resource allocation, and ultimately, respond to student-related achievements and parental responses. The above analysis shows that the problem of the balance measurement of compulsory education resources allocation can be characterized by the three dimensions of "pressure-state-response", which is in line with the basic idea of PSR theory.

Using PSR analysis framework to build a control indicator system for the equilibrium measurement of compulsory education resource allocation, the indicator system can reflect not only the cyclical coordination relationship of the "effect-feedback-action" of the three levels of stress, state, and response faced by the balanced allocation of compulsory education resources but also the process and results of the balanced allocation of compulsory education resources. The degree of the hard work of the students in compulsory education and the level of the teachers' efforts have put pressure on the balanced allocation of compulsory education resources. Many aspects of compulsory education resource allocation reflect the current level of configuration, student grades, and parental responses reflect a series of results from the balanced allocation of compulsory education resources. The stress and state system reflect the process of the balanced allocation of compulsory education resources while the response system reflects the results of the balanced allocation of compulsory education resources. Therefore, from the three aspects of the degree of effort (pressure dimension), compulsory education resource allocation state (state dimension), and related party response (response dimension) to establish the indicator system, a system of measurement indicators for the allocation of compulsory education resources is formed.

The overall construction of the compulsory education resource allocation balance measurement control index system based on PSR theory is shown in Figure 4.
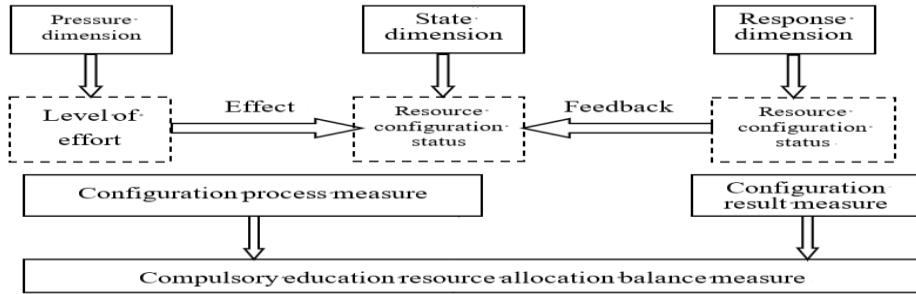
Figure 4. Schematic diagram of index system based on PSR theory

According to the above construction framework of the compulsory education resource allocation balance measure control index system, combined with the situation of compulsory education resource balance allocation work, a control index system of compulsory education resource allocation balance measure is proposed and shown in Table 2.

Table 2
Compulsory Education Resource Allocation Balance Measure Mandatory Index System

Target layer	Dimension layer	Indicator layer
Compulsory education resource allocation balance measure mandatory index system	Pressure dimension (P)	Curriculum development and implementation X_{p1}
		Student activity participation level X_{P2}
		Students' studying time at school X_{P3}
	Status dimension (S)	Education funding per student X_{s1}
		Number of teachers per student X_{s2}
		Number of books per student X_{s3}
		Sports venue area per student X_{s4}
	Response dimension (R)	Average score of major subjects X_{r1}
		Student physical fitness compliance rate X_{r2}
		School choice X_{r3}
		Student satisfaction X_{r4}
		Parent satisfaction X_{r5}

The constructed compulsory education resource allocation balance measure control index system involves the pressure, state, and response dimensions. Each dimension has corresponding specific indicators. The indicator system consisting of 3 dimensions and 12 indicators, which comprehensively reflect the balance of compulsory education resource allocation.

Theoretical Model

When aiming at the balanced allocation of compulsory education resources in a single region, first calculating the respective Gini coefficients for all 12 indicators in the equilibrium education index system for compulsory education resources is necessary. According to the degree of importance of each indicator, the comprehensive balance of compulsory education resource allocation in the region is calculated.

Calculation of Gini Coefficient of Compulsory Education Resource Allocation

According to the definition of the Gini coefficient, the following definitions can be given.

For a single region, *m* schools during the compulsory education stage are assumed and sorted according to the magnitude of the index of the compulsory education resource allocation balance measure indicator. The index value of the first school after the ranking is denoted by a_1 in the whole region, the proportion of students in the whole region is b_1, and so on. After the ranking, the index value of the first school in the whole region is a_i and the proportion of students in the whole region is b_i. Then, the corresponding data $(b_1, a_1), (b_2, a_2),$ $(b_i, a_i), ..., (b_m, a_m)$ can be sequentially connected on a Cartesian coordinate system to obtain the Lorenz line.

We can calculate the Gini coefficient under the indicator

$$G = -(1 + \sum_{i=1}^{m} a_i b_i - 2 \sum_{i=1}^{m} (\sum b_i) a_i) \tag{1}$$

$\sum b_i$ is the cumulative proportion of students accumulating to the group *i* $\tag{2}$

Calculation of comprehensive equilibrium degree of compulsory education resource allocation

According to the formula given in Section 3.1, on the basis of the Gini coefficient of compulsory education resource allocation, the comprehensive degree of compulsory education resource allocation as the basis for evaluating the resource allocation balance of compulsory education in a single region is calculated.

Since there are 12 indicators in the compulsory education resource allocation balance measurement index system, 12 corresponding compulsory education resource allocation Gini coefficients can be calculated.

The set of all the compulsory education resource allocation Gini coefficients is $G_k (k = 1, 2, ..., 12)$, and the set of weights of the 12 indicators is $W_k (k = 1, 2, ..., 12)$.

Accordingly, we can configure a measure of the balance for a single regional compulsory education resource. The comprehensive balance of compulsory education resource allocation in a single region is denoted by *B*, then

$$B = G_k \otimes W_k. \tag{3}$$

According to the definition criteria of the comprehensive equilibrium of compulsory education resource allocation as defined in Table 1, the equilibrium allocation of compulsory education resources in a single region can be judged accordingly (Costa, Albuquerque, Thomas & Machado, 2018; Sardenne *et al*., 2017; Liu, Shen, Meng & Sun, 2018; Bengtsson-Palme, Kristiansson & Larsson, 2018; Wu *et al*., 2017).

Method for determining weight of control index system according to improved GAHP method

Although the Group Analytic Hierarchy Process (GAHP) method can achieve the goal of multi-person decision weights, in the actual use process, the GAHP method can only achieve the "1-9" relative importance comparison value between the two-two indicators. In fact, when subjective judgments on the relative importance of two-two indicators are not simply relying on a single number for intuitive representation, the application of interval values can better reflect the opinions of experts. In addition, because experts have different life backgrounds and experiences, there are still great differences in the determination of the weights of the indicators. There may be great uncertainty in the specific calculation process, so clarifying the weight of the experts is necessary.

In view of the shortcomings of the traditional GAHP method, this study improved the traditional GAHP method to form an improved GAHP method, which was applied to the weight determination of the compulsory education resource allocation balance measure control index system.

Because in the GAHP method, the core content is the expert's determination of the relative importance of the relative importance of the two-two indicators, the focus is on the method for determining the relative importance of the two-two indicators (Xiong, Zhao, Yuan & Luo, 2017; Zheng, Zhang & Yan, 2013).

Suppose that there are *K* experts participating in the determination of the weights of the control index system

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in the measurement of the balance of resource allocation in compulsory education, in the process of determining the weight of the indicator system, the $k(k=1,2,…,K)$ expert compares the relative importance of the two indicators x_g and x_h at the same level to the interval value $[d_{1e}^{(k)}, d_{2e}^{(k)}]d_{2e}^{(k)} \geq d_{2e}^{(k)}$, and the weight of each expert is $c_k, (k = 1,2, …, K)$ then the relative importance of the two indicators x_g and x_h is

$$f_{g,h} = \frac{1}{2} \cdot \frac{\sum_{k=1}^{K}\{[d_{2e}^{(k)}]^2 - [d_{1e}^{(k)}]^2\} \cdot c_k}{\sum_{k=1}^{K}[d_{2e}^{(k)} - d_{1e}^{(k)}] \cdot c_k}. \tag{4}$$

After the relative importance comparison values between the two-two indicators under the same level is according to the above method is determined, the weight of the control index system in the measurement of the balance of compulsory education resource allocation is determined according to the steps and requirements of the GAHP method. The weight of each indicator x_{ij} in the compulsory education resource allocation balance measurement index system is $w_{ij}(i = p, s, r; j = 1,2, …, n)$.

Case analysis

In recent years, AN County has regarded compulsory education as the top priority of education reform and development and has done much to improve policies, enhance connotation, strengthen security, and narrow the gap in regional, urban and rural, inter-school, and group education development. According to the results of state supervision, the county has already established the "National Compulsory Education Basic Balance Development County (City, District)".

Obtaining Measurement Data in AN County

AN County has eliminated dangerous houses and obvious safety hazards. The number of teachers and staff in each place exceeds 90% of the total amount of preparation. The school assets of the compulsory education are all in line, which means that the four aspects of the compulsory indicators in the assessment index system of the compulsory education resources of AN County have met the requirements. Therefore, when specifically measuring the balance of resource allocation in compulsory education only analyzing the relevant data of the control indicators and calculating the Gini coefficient for the compulsory education resources corresponding to the control indicators are necessary. The weight of each indicator in the system calculates the comprehensive balance of compulsory education resource allocation in the region. These involve the acquisition of basic data.

There are 35 compulsory education schools, denoted by AN1, AN2,…, AN35, in AN County.

According to the method for determining the magnitude of the measurement index of the compulsory education resource allocation balance, an evaluation agency determines the method using the three types of indicators, organizes experts to score the two indicators of curriculum development and implementation (X_{p1}), as well as student activity participation (X_{p2}) in each county (district). The index data, which include 6 indexes— per capita education expenses (X_{s1}), the number of teachers per student (X_{s2}), number of students per student (X_{s3}), per capita education expenses of the per capita sports venues (X_{s4}), average subject average student education expenditure (X_{r1}), and student physical fitness compliance rate (X_{r2}), required by each school are reviewed by the county education authorities. The district authorities will obtain data on the corresponding indicators, which include student study time (X_{p3}), school choice (X_{r3}), student satisfaction (X_{r4}), and parental satisfaction (X_{r5}), of each school in the district through a sample survey. The index value of the measurement of the balance of compulsory education resources allocation in compulsory education schools in AN County is obtained, as shown in Table 3.

Table 3

Values of Relevant Indicators in AN County

| | Compulsory education resource allocation balance measure mandatory index system | | | | | | | | | | | | |
| | Pressure dimension | | | Status dimension | | Response dimension | | | | | | | |
Target layer	Curriculum development and implementation X_{p1}	Student activity participation level X_{P2}	Students' studying time at school X_{P3}	Education funding per student X_{s1}	Number of teachers per student X_{s2}	Number of books per student X_{s3}	Sports venue area per student X_{s4}	Average score of major subjects X_{r1}	Student physical fitness compliance rate X_{r2}	School choice X_{r3}	Student satisfaction X_{r4}	Parent satisfaction X_{r5}	Number of students
AN1	96.12	95.18	6.82	12684	0.074	22.93	9.64	92.17	99.15	95.98	98.88	98.87	820
AN2	90.85	89.86	6.31	11712	0.063	21.86	10.36	86.32	97.65	92.62	97.63	96.66	784
AN3	87.86	86.61	6.60	11639	0.063	19.44	9.68	91.56	96.77	94.20	96.51	96.69	832
AN4	91.26	89.26	6.47	12647	0.061	16.90	9.36	88.49	95.24	93.52	95.43	95.39	734
AN5	90.16	89.81	6.75	12782	0.054	20.48	9.32	89.38	97.25	95.56	97.12	96.77	740
AN6	91.08	89.68	6.84	11493	0.057	19.47	11.45	86.92	94.32	99.26	95.21	94.05	704
AN7	91.74	92.6	6.99	11631	0.056	22.36	9.46	97.18	97.77	90.57	97.83	98.42	749
AN8	96.69	90.4	6.66	12652	0.066	22.46	8.37	92.36	92.78	92.43	92.20	92.17	742
AN9	94.94	94.05	7.02	12498	0.061	21.38	7.76	91.70	94.59	95.43	94.38	95.07	786
AN10	93.62	92.6	6.88	12858	0.069	21.98	8.98	89.03	97.11	93.38	96.77	98.12	631
AN11	95.66	93.4	7.03	12615	0.073	20.51	10.36	87.73	94.84	95.65	94.12	95.21	703
AN12	91.26	88.91	6.88	12716	0.068	20.14	11.56	88.97	94.75	96.54	94.95	95.35	590
AN13	90.18	88.27	6.85	12042	0.070	21.28	10.00	90.78	97.08	95.00	97.00	97.86	703
AN14	92.36	92.4	6.80	12396	0.075	23.97	10.97	91.56	92.77	90.92	92.90	92.42	749
AN15	91.66	90.33	7.00	12948	0.063	24.19	12.38	93.33	96.09	90.32	95.73	95.97	872
AN16	93.93	92.93	6.65	12793	0.058	16.79	8.92	89.19	97.26	93.41	96.54	97.29	673
AN17	95.07	91.37	7.07	12261	0.056	16.92	11.04	87.94	97.68	92.66	97.65	97.86	664
AN18	92.52	90.74	7.43	12678	0.064	20.37	11.05	92.67	99.03	97.16	98.72	95.25	704
AN19	92.23	90.07	6.41	13495	0.066	23.26	11.06	93.54	97.56	95.64	97.59	97.30	804
AN20	93.16	91.95	6.41	12825	0.061	19.47	10.04	90.72	98.76	97.13	98.58	98.71	761
AN21	95.15	92.18	6.63	12625	0.075	23.20	10.68	90.12	97.10	92.82	97.27	96.81	774
AN22	95.98	95.44	6.86	12392	0.076	21.91	12.10	91.66	95.73	95.32	97.02	96.78	785
AN23	92.50	91.54	7.07	11920	0.074	24.48	10.23	88.61	99.13	95.43	98.58	99.82	792
AN24	93.27	92.13	7.73	12915	0.070	20.06	10.01	88.23	97.17	94.28	96.89	97.45	783
AN25	90.74	90.08	6.40	12490	0.069	23.80	8.60	91.22	98.94	96.24	98.70	99.72	804
AN26	91.94	90.94	6.53	12438	0.056	18.25	8.92	89.29	97.22	93.08	96.72	97.46	705
AN27	92.02	90.28	7.34	11844	0.068	15.22	8.33	87.37	97.89	92.22	97.17	96.27	784
AN28	95.18	91.56	7.16	11840	0.061	20.98	10.39	95.17	97.85	95.52	98.69	98.22	687
AN29	90.67	90.86	6.91	13688	0.057	20.44	9.88	95.63	98.08	93.05	97.44	98.03	678
AN30	93.02	91.26	7.37	13223	0.075	15.86	9.45	94.61	94.82	90.91	94.54	94.85	604
AN31	93.37	91.03	6.35	14420	0.064	20.70	9.31	91.92	97.18	94.76	97.10	96.90	704
AN32	93.50	91.15	6.23	13508	0.075	20.27	8.53	91.46	98.06	93.68	97.58	97.88	841
AN33	93.21	92.7	6.63	12627	0.073	20.11	10.27	90.76	99.18	94.66	98.75	99.23	784
AN34	92.72	92.9	6.58	13805	0.072	18.41	11.37	91.42	95.84	94.01	95.82	95.69	792
AN35	93.72	90.87	6.62	12581	0.068	22.12	8.68	91.83	94.88	94.95	94.70	95.26	638

Implementation of Measurement in AN County

Determination of Weight

According to the method for determining the weight of the control index system listed in this paper, the evaluation-implementing organization organizes a number of experts to determine the specific weight of the compulsory education resource allocation balance measurement index system and determine the relative importance comparison value of two-two indicators according to FORMULA (4), as well as the steps and requirements of the AHP method, and determines the weight of the control index system in the measurement of the balance of compulsory education resource allocation.

Following the opinions of the experts, the weights of the compulsory education resource allocation balance measurement index system were finally obtained and are shown in Table 4.

Table 4
Results of determination of weight

Target layer	Dimension layer	Indicator layer	Weight of indicator layer relative to target layer
Compulsory education resource allocation balance measure mandatory index system	Pressure dimension (P)	Curriculum development and implementation X_{p1}	0.1238
		Student activity participation level X_{P2}	0.0682
		Students' studying time at school X_{P3}	0.0819
	Status dimension (S)	Education funding per student X_{s1}	0.1067
		Number of teachers per student X_{s2}	0.0817
		Number of books per student X_{s3}	0.0721
		Sports venue area per student X_{s4}	0.0515
	Response dimension (R)	Average score of major subjects X_{r1}	0.0886
		Student physical fitness compliance rate X_{r2}	0.0729
		School choice X_{r3}	0.0741
		Student satisfaction X_{r4}	0.1002
		Parent satisfaction X_{r5}	0.0782

After the weight of the compulsory education resource allocation balance measurement index system has been determined, the following step can be based on the compulsory education resource allocation balance measurement method proposed in this paper, and the measurement of the equal allocation of the compulsory education resource allocation in the county can be conducted.

AN County Compulsory Education Resource Allocation Balance Measurement

The measurement of the balanced allocation of compulsory education resources in AN County is conducted according to the relevant indicators of the compulsory education schools in AN County listed in TABLE 3. According to the measurement process, firstly, all 12 indicators in the equilibrium measurement index system are configured for compulsory education resources and their respective Gini coefficients are calculated according to FORMULA (1). The results are shown in Table 5.

Table 5
Gini Coefficient in AN County under Various Indicators

Indicator layer	Gini Coefficient
Curriculum development and implementation X_{p1}	0.087
Student activity participation level X_{P2}	0.083
Students' studying time at school X_{P3}	0.093
Education funding per student X_{s1}	0.037
Number of teachers per student X_{s2}	0.076
Number of books per student X_{s3}	0.108
Sports venue area per student X_{s4}	0.098
Average score of major subjects X_{r1}	0.045
Student physical fitness compliance rate X_{r2}	0.041
School choice X_{r3}	0.031
Student satisfaction X_{r4}	0.042
Parent satisfaction X_{r5}	0.028

According to the results in Table 5, combined with the index weights listed in Table 4, and according to FORMULA (3), the comprehensive balance of the compulsory education resource allocation in AN County is calculated. The results show that the comprehensive balance of compulsory education resource allocation in AN County is 0.003.

According to the definition criteria of the balanced allocation of compulsory education resources proposed in TABLE 1, the state of compulsory education resources allocation in AN County is absolutely balanced.

Conclusion

This paper explains the concepts of the Gini coefficient and the comprehensive equilibrium of compulsory education resource allocation. The coefficient was used as a measure of the balanced allocation of compulsory education resources. The paper also proposes forward specific quantitative standards. To effectively realize the measurement of the comprehensive equilibrium of compulsory education resources according to an analysis of the influencing factors of the balanced allocation of compulsory education resources, a measurement index system of the compulsory education resource allocation balance consisting of mandatory and control indicators was constructed. A compulsory education resource allocation balance measurement model, which provides important support to the scientific implementation of the compulsory education resource allocation balance measurement work and promotion strategy was also described.

Discussion

(1) The government should promote the balanced development of compulsory education through the balanced allocation of compulsory education resources. In recent years, with the increasing emphasis of the Chinese government on the balanced development of compulsory education, many regions, especially the eastern coastal areas, have achieved a basic, balanced allocation of compulsory education resources. The government should enhance the effectiveness of the development of compulsory education. The development of compulsory education to a higher level will be promoted and included in the government work schedule. As one of the important guarantees for achieving the goal of compulsory education through the establishment of a scientific and rational compulsory education resource allocation system, especially the establishment of a scientific compulsory education resource allocation quality balance measurement index system and measurement method, the balanced development of compulsory education quality will be promoted. This problem requires further exploration.

(2) It is necessary to establish a special financial subsidy system for economically underdeveloped areas, and introduce special policies to ensure that these regions can effectively implement compulsory education resource allocation, thereby effectively ensuring the smooth realization of the goal of a balanced allocation of compulsory education resources.

(3) It is necessary to relieve government pressure by introducing social forces to create a quality education. Government departments should gradually promote the participation of social forces in compulsory education. Because of the compulsory education stage of social power, the orientation of the schools is basically quality education, which relieves the pressure of the government departments to a certain extent, so that the departments can have more energy and financial resources to invest in compulsory education and guarantee the allocation of compulsory education resources.

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