

# Evaluation and Optimization of Compulsory Education Policy Based on PMC-AE Index Model

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**Abstract:** *Issues such as whether the formation of compulsory education policies is acceptable, and whether the function and effect of high-quality compulsory education development are substantial are key foundations for future policymaking. Combining text mining, content analysis and other methods, this research employs the PMC-AE index model to quantitatively evaluate the content of 60 representative compulsory education policy texts released by various provinces in China from 2005 to 2022, so as to provide a foundation for the formulation, adjustment, and improvement of compulsory education policies. It is found that policy samples from Jiangsu, Beijing, and Shanghai score higher, whereas policy samples from Jilin, Chongqing, and Heilongjiang score relatively lower. Compulsory education policies can be improved from aspects such as policy audiences, policy priorities, policy functions, and incentive-constraint.*

**Keywords:** *compulsory education; policy evaluation; PMC-AE index model*

## 1. Introduction

Compulsory education has always been the top priority of China's education reform and development. In the process of China's sustained and rapid development, compulsory education in China has gradually got its own unique characteristics. According to incomplete statistics, more than 2700 policies on compulsory education have been issued since China implemented nine-year compulsory education in 1986. However, with the development of society, higher requirements had been put forward for future development compulsory education. In order to effectively promote the development and improve quality of compulsory education in China, the state has issued a series of policies. Meanwhile, to respond to them, provincial governments have also successively issued relevant planning texts and construction plans. Especially, after the state implemented "double reduction"<sup>1</sup> policy in 2020, Shanghai issued "Shanghai Compulsory Education 'Double Reduction' Work Supervision Scheme", the People's Government of Beijing Municipality issued "Beijing's Measures to Further Alleviate the Burden of Students' Homework and Off-campus Training in Compulsory Education", Jiangsu Provincial Department of Education issued "Jiangsu Compulsory Education Students' Homework Management Standard" and "Jiangsu Compulsory Education Schools' Examination Management Standard", to comprehensively improve the level of compulsory education and education quality through the guidance and incentives of relevant policies, so as to accelerate the process of compulsory education development. With the increasing number of policies on compulsory education, the policy system is becoming more and more complex. Are these policies introduced comprehensive and appropriate? Can we achieve the expected goal? Does the formulation of policy texts meet the actual needs? Is the effect on the development of compulsory education significant? What mechanism through which do these policies promote development? To answer these questions, it is necessary to quantitatively evaluate the compulsory education policy scientifically. This research quantitatively evaluates compulsory education policies promulgated by 31 provinces (municipalities) in China, makes a comparative analysis of policies in different regions, and puts forward targeted optimization schemes based on the results.

Contributions of this paper include: (1) The PMC index model (Policy Model Consistency) and AE (Auto Encoder) technology are combined to improve the accuracy and practicability of evaluation results. (2) This paper takes the compulsory education policy text as the research object to carry on the quantitative evaluation, providing a more practical and feasible method for policy evaluation.

<sup>1</sup> "Double reduction" means to effectively reduce the heavy homework burden and Off-campus training burden of students in the stage of compulsory education.

## 2. Literature Review

### 2.1 Research on Policy Evaluation

Domestic and foreign scholars have carried out a lot of research on policy evaluation methods. In the early 1970s, policy evaluation tended to be empirical, emphasizing social planning, social experiments and mathematical analysis. Later, scholars gradually paid attention to the norm-based methodology of value judgment, represented by Olive F Poland's "three E" evaluation classification framework<sup>[1]</sup> and Edward A. Suchman's five evaluation types<sup>[2]</sup>. The object of policy evaluation can be either policy content, policy implementation process or implementation effect. Among them, the methods commonly used in policy content evaluation are text analysis, co-word analysis, analytic hierarchy process and so on. For example, Guo used R language and text analysis to conduct thematic mining and quantitative analysis of the government's PV industry innovation policy from 2007 to 2019, and studied the correlation characteristics between industrial innovation policies at different levels<sup>[3]</sup>. Wu used social network analysis and co-word analysis to deeply analyze the content of innovation policy texts, and constructed a quantitative framework based on the evaluation of manufacturing innovation policy<sup>[4]</sup>. He used text measurement, text mining, content analysis and other methods to systematically quantify the text, evaluate the effectiveness and explore the use of the new talent policy in various cities<sup>[5]</sup>. Cai analyzed the dynamic changes of social welfare and subsidy policies that affect its changes and other factors through numerical simulation, and proposed corresponding incentive policy recommendations<sup>[6]</sup>. The above methods, such as content analysis and analytic hierarchy process are scientific but subjective. Therefore, if we combine qualitative and quantitative methods and introduce various methods such as bibliometrics, network analysis and content analysis into policy text research, we can effectively realize the complementary advantages of various methods and then comprehensively evaluate policies.

### 2.2 Research on Compulsory Education Policy

In terms of policy content, Wang thought that China's compulsory education policy generally presents the basic characteristics of policy value oriented by education equity and top-down system adjustment dominated by the government<sup>[7]</sup>. Zhang pointed out that efficiency and fairness are always running through the development of compulsory education policy in China, and the integration of efficiency and fairness is the only way for the future development of compulsory education<sup>[8]</sup>. He believed that China's compulsory education teacher resource allocation policy has gone through four stages: exploration and reconstruction, transition of old and new education systems, steady progress with focus and deepening reform<sup>[9]</sup>. Guo's experience in screening evaluation indicators based on policy needs, taking into account stability and innovative optimization of core content, provides useful inspiration for China to build a monitoring framework for the influencing factors of compulsory education quality<sup>[10]</sup>. Wang pointed out that to improve the effectiveness and sustainability of policy formulation and implementation, it is necessary to improve the accuracy, contingency and systematicness of education policies and promote education reform under the legal framework<sup>[11]</sup>. Secondly, in a certain type of policy text analysis, Li from the public and private compulsory education schools, government and education departments, parents and students, education related industries and other different groups of interest game analysis of compulsory education "citizen co-recruitment" governance path<sup>[12]</sup>. Based on the three-dimensional framework of "space, process and element", Ma analyzed the attention distribution of compulsory education policy, and found that by optimizing the structure of policy attention distribution, inter-temporal dynamic allocation of policy attention can effectively promote the transition of compulsory education to high-quality balance<sup>[13]</sup>. Based on the CFPS data in 2016, Jia used the exogenous impact of free compulsory education policy to examine the causal impact of free compulsory education policy on rural multi-dimensional human capital accumulation by using the difference-in-differences method<sup>[14]</sup>. Peng analyzed and verified that the above two education policies have no correlation with the intergenerational mobility of rural residents' education from the perspective of intergenerational mobility of education and upward mobility of education<sup>[15]</sup>. Li uses the Delphi method to construct the tree value system of compulsory education policy planning with "border characteristics", which is helpful to determine the direction of compulsory education policy planning in border areas<sup>[16]</sup>.

To sum up, most of current research on compulsory education policy is descriptive analysis of policy content or analysis of a certain type of compulsory education policy text, which has certain enlightenment on the development of compulsory education. However, there are few studies on quantitative evaluation of compulsory education policy from an overall perspective. Therefore, based on the PMC-AE index model, this research comprehensively uses text mining and content analysis to analyze and evaluate the

compulsory education policy texts of 31 provinces (municipalities) in China, providing references for optimization of relevant policies in each province (municipality).

### 3. Quantitative Evaluation of PMC-AE Index Model of Compulsory Education Policy

The PMC-AE index model is a policy text evaluation method. It sets different variables from different dimensions to analyze the policy, and realizes multi-dimensional evaluation and specific analysis of individual indicators<sup>[17]</sup>, so as to comprehensively and scientifically quantify the policy. The traditional PMC index calculation is simply adding up the values and then taking the average, which is unable to measure the relationship between different policy evaluation indicators<sup>[18]</sup>. Therefore, this research combines self-encoding AE technology when calculating PMC index, to better integrate the information of each index and improve the scientific and accuracy of evaluation.

#### 3.1 Sample Selection and Variable Classification

The compulsory education policies issued by 31 provinces (municipalities) governments in China has been selected and the content of the policy text has been quantitatively analyzed through constructing the PMC-AE evaluation index system. To analyze policies more effectively, representative policies need to be selected as samples. In 2005, the Ministry of Education issued "Several Opinions on Further Promoting the Balanced Development of Compulsory Education", which is regarded as a turning point in the development of compulsory education in China. Therefore, 60 compulsory education policies issued by 31 provincial (municipal) governments in 2005 and later are selected as research samples.

ROSTCM6 text mining software is applied to preprocess the text content of compulsory education policy. Firstly, the content of the policy text is segmented, and the word frequency statistics are performed on the segmentation results. On this basis, high-frequency words are extracted and provides a theoretical basis for the determination of subsequent primary and secondary evaluation indicators. As the research object is compulsory education policy, the frequency of "Compulsory Education" and "Policy" vocabularies is relatively high, and the verb vocabularies such as "Improve", "Promote" and "Strengthen" have no practical significance for the analysis of the characteristics of compulsory education policy. They are deleted from the statistical results of word frequency. The top 60 words and word frequency are finally sorted out (shown in table 1).

Table 1: Top 60 vocabulary and word frequency statistics of compulsory education policy

vocabulary	Word frequency	vocabulary	Word frequency	vocabulary	Word frequency	vocabulary	Word frequency	vocabulary	Word frequency
Schools	2672	Institutions	668	Government	419	Post-course	325	Legal	258
Teachers	1867	Mechanism	655	Standard	412	Examination	318	Emphasis	257
Students	1369	Service	623	Discipline	408	Learning	315	Qualification	250
Balanced development	1242	Quality	562	Standard	393	Planning	307	Pilot	248
Training	1177	Course	526	Evaluation	388	Supervision	298	Administrative department	245
Teaching	972	Primary and secondary school	525	Coordination	377	State	298	Primary and middle school students	239
Construction	924	Off Campus	491	Rural education	363	Problem	296	Policy	237
Management	905	Social	471	Guidance	353	Lighten	290	Guidance	237
Homework	863	Organization	461	Urban and Rural	335	Burden	289	Inspection	235
Alleviating burdens for efficiency	822	Security	459	Funds	332	Science	286	Reasonable	232
Department	681	Resources	442	Innovation	331	Strengthening	279	Colleges	230
Reform	674	System	435	Parents	331	Cultivation	276	Synthesis	230

It can be seen from table 1 that "Schools", "Teachers", "Students", "Balanced development", "Teaching", "Alleviating burdens for efficiency", "Institutions", "Course" and other words appear more frequently in the text of compulsory education policy. Thus, balanced development is the top priority for compulsory education in China. A series of measures, such as reducing the burden of students' homework, rational allocation of teachers' resources, creation of various courses, and rectification of off-campus training institutions, are the key to ensuring quality of compulsory education and improving level of balanced development for compulsory education.

Table 2: Compulsory education policy evaluation index system

First-level variable	Second-level variable	Evaluation criteria for second-level variables	Evaluation parameter	Source or basis
Policy Duration X1	Long term $X_{1,1}$	Judge whether the policy limitation period is more than 10 years	$X_{1,1} \sim N[0,1]$	Estrada <sup>[17]</sup>
	Medium term $X_{1,2}$	Judge whether the policy limitation period is 6-10 years	$X_{1,2} \sim N[0,1]$	
	Short term $X_{1,3}$	Judge whether the policy limitation period is 1-5 year	$X_{1,3} \sim N[0,1]$	
	Temporary $X_{1,4}$	Judge whether the policy limitation period is within 1 year	$X_{1,4} \sim N[0,1]$	
Policy Nature X2	Encourage $X_{2,1}$	Judge whether the policy has a tendency to encourage and support	$X_{2,1} \sim N[0,1]$	High-frequency words based on text mining
	Suggestion $X_{2,2}$	Judge whether the policy has a tendency to recommend and guide	$X_{2,2} \sim N[0,1]$	
	Supervision $X_{2,3}$	Judge whether the policy has supervision and management tendency	$X_{2,3} \sim N[0,1]$	
	Mandatory requirement $X_{2,4}$	Judge whether the policy has mandatory requirement tendency	$X_{2,4} \sim N[0,1]$	
Policy Audience X3	Schools $X_{3,1}$	Judge whether the policy involves schools	$X_{3,1} \sim N[0,1]$	High-frequency words based on text mining
	Teachers $X_{3,2}$	Judge whether the policy involves teachers	$X_{3,2} \sim N[0,1]$	
	Students $X_{3,3}$	Judge whether the policy involves students	$X_{3,3} \sim N[0,1]$	
	Extramural institutions $X_{3,4}$	Judge whether the policy involves extramural institutions	$X_{3,4} \sim N[0,1]$	
	Parents $X_{3,5}$	Judge whether the policy involves parents	$X_{3,5} \sim N[0,1]$	
	Principals $X_{3,6}$	Judge whether the policy involves principals	$X_{3,6} \sim N[0,1]$	
Policy Perspective X4	Macrocosm $X_{4,1}$	Judge whether the policy perspective involves the macro-level	$X_{4,1} \sim N[0,1]$	Cheng <sup>[20]</sup>
	Mid-scope $X_{4,2}$	Judge whether the policy perspective involves the meso-level	$X_{4,2} \sim N[0,1]$	
	Microcosm $X_{4,3}$	Judge whether the policy perspective involves the micro-level	$X_{4,3} \sim N[0,1]$	
Policy Focus X5	Student development $X_{5,1}$	Judge whether the policy involves student development	$X_{5,1} \sim N[0,1]$	High-frequency words based on text mining
	Faculty distribution $X_{5,2}$	Judge whether the policy involves faculty distribution	$X_{5,2} \sim N[0,1]$	
	Course design $X_{5,3}$	Judge whether the policy involves course design\	$X_{5,3} \sim N[0,1]$	
	Funding guarantees $X_{5,4}$	Judge whether the policy involves funding guarantees	$X_{5,4} \sim N[0,1]$	
	Quality evaluation $X_{5,5}$	Judge whether the policy involves quality evaluation	$X_{5,5} \sim N[0,1]$	
Policy Function X6	Management and service $X_{5,6}$	Judge whether the policy involves management and services	$X_{5,6} \sim N[0,1]$	High-frequency words based on text mining
	Regularization of running school behavior $X_{6,1}$	Judge whether the policy involves regulating school behavior	$X_{6,1} \sim N[0,1]$	
	Reform of the ensuring system $X_{6,2}$	Judge whether the policy involves reforming of the ensuring system	$X_{6,2} \sim N[0,1]$	
	Improve the quality of compulsory education $X_{6,3}$	Judge whether the policy involves improving the quality of compulsory education	$X_{6,3} \sim N[0,1]$	
Incentive-constraint X7	Promoting the construction of teaching staff $X_{6,4}$	Judge whether the policy involves promoting the construction of teachers	$X_{6,4} \sim N[0,1]$	High-frequency words based on text mining
	Funding $X_{7,1}$	Judge whether the policy involves capital investment	$X_{7,1} \sim N[0,1]$	
	Defining duty $X_{7,2}$	Judge whether policy involves clear accountability	$X_{7,2} \sim N[0,1]$	
	Supervision and inspection $X_{7,3}$	Judge whether the policy involves supervision and inspection	$X_{7,3} \sim N[0,1]$	
	Strengthen the leadership $X_{7,4}$	Judge whether policy involves strengthening leadership	$X_{7,4} \sim N[0,1]$	
Policy Evaluation X8	Performance appraisal $X_{7,5}$	Judge whether policy involves performance appraisal	$X_{7,5} \sim N[0,1]$	Zhang <sup>[21]</sup>
	Sufficient basis $X_{8,1}$	Judge whether the policy has sufficient basis	$X_{8,1} \sim N[0,1]$	
	Clear aim $X_{8,2}$	Judge whether the policy has clear objectives	$X_{8,2} \sim N[0,1]$	
	Scheme science $X_{8,3}$	Judge whether there is a scientific plan for policy	$X_{8,3} \sim N[0,1]$	
Policy Type X9	Detailed planning $X_{8,4}$	Judge whether the policy has detailed planning	$X_{8,4} \sim N[0,1]$	Cheng <sup>[20]</sup>
	Planning-type $X_{9,1}$	Plannings, Outlines, Regulations, Norms	1	
	Scheme-type $X_{9,2}$	Strategic schemes, Rules, Guidelines	0.8	
	Method-type $X_{9,3}$	Methods, Measures, Regulations	0.6	
	Opinion-type $X_{9,4}$	Opinions, Decisions	0.4	
	Notification-type $X_{9,5}$	Notifications, Announcements	0.2	

In order to evaluate the compulsory education policy systematically and comprehensively, a quantitative evaluation framework including 9 first-level variables and 41 second-level variables is constructed by referring to the policy evaluation index setting method proposed by Zhang<sup>[19]</sup>, combined with the analysis results of high-frequency words of compulsory education policy, as shown in Table 2.

### 3.2 Construction of Multi-input-output Table

Based on the evaluation index system of compulsory education policy, a multi-input-output table of

9 first-level variables and 41 second-level variables is constructed, and each variable is assigned according to the text content of the policy sample. If the value is assigned to 1, it represents the content that satisfies the secondary variable in the policy text. A value of 0 indicates that the secondary variable is not satisfied in the policy text. Referring to the research of Cheng on the quantification of innovative policies<sup>[20]</sup>, the evaluation parameters of the second-level variables with the first-level variable of Policy Type (X9) are set as the itemized decreasing values within the range of [0,1].

### 3.3 PMC-AE Index Calculation

The calculation of the first-level variables in the PMC index model is obtained through simple weighted average of the second-level variables, which is unable to measure the relationship between indicators at all levels. Therefore, the auto-encoder AE technology is introduced and integrated with the PMC index model, so that the obtained values can better reflect the relationship between indicators at all levels.

$$\begin{cases} h = f(X) = \frac{1}{1+e^{-(WX+p)}} \\ Y = g(h) = \frac{1}{1+e^{-(W'h+q)}} \end{cases} \quad (1)$$

Sigmoid function is selected as the activation function of  $f$ ,  $g$  (Equation (1)) to calculate the data in multi-input-output table. The empirical analysis of this research shows that when the first-level variable is fully divided into 1, the value range of the first-level variable is set to [0.7,0.9], which can more truly reflect the characteristics of the policy. Using Python to debug many times, it is found that when  $p$ ,  $q$  take 1, the index score converges to the expected value better, and the PMC-AE index of each compulsory education policy is calculated.

Considering the limited space, just the score of the top three and bottom three provinces (municipalities) are shown in table 3. The higher the policy scores, the higher the level of the compulsory education policy, and the wider the content of the indicators involved. Conversely, it shows that the level of the compulsory education policy is relatively low, and there is large space for improvement.

Table 3: The score of compulsory education policies by province(municipality)

	X1	X2	X3	X4	X5	X6	X7	X8	X9	Scores
Jiangsu	0.777	0.852	0.862	0.791	0.881	0.881	0.858	0.881	1	7.783
Beijing	0.777	0.881	0.862	0.791	0.841	0.852	0.858	0.881	1	7.743
Shanghai	0.777	0.852	0.881	0.791	0.862	0.852	0.832	0.881	1	7.728
Jilin	0.777	0.777	0.841	0.791	0.812	0.777	0.832	0.852	0.2	6.659
Chongqing	0.777	0.812	0.791	0.791	0.791	0.812	0.802	0.852	0.2	6.628
Heilongjiang	0.777	0.812	0.763	0.791	0.763	0.777	0.832	0.852	0.2	6.567

### 3.4 PMC-AE surface construction

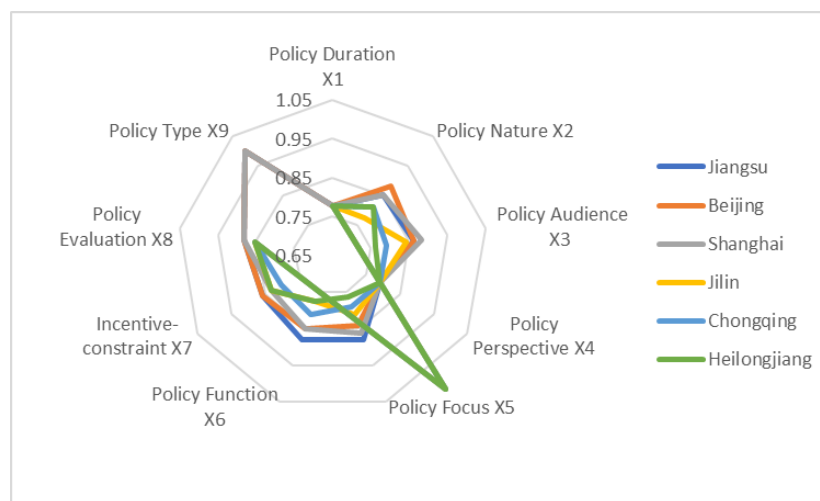


Figure 1: Radar chart of compulsory education policy in each province (municipality)

Here, the scores of compulsory education policies of the six provinces (municipalities) (top three and bottom three) are displayed by radar chart (Figure 1) to intuitively reflect the overall differences of the

first-level variables in each province. It can be seen from Figure 1 that large differences mainly lie in Policy Nature (X2), Policy Audience (X3), Policy Focus (X5), Policy Function (X6) and Policy Type (X9). Indicators with relatively small differences are Incentive-constraint (X7) and Policy Evaluation (X8).

In order to understand the situation of compulsory education policy in each province (municipality) more stereoscopically, the PMC-AE surface chart (Figure 2) is drawn according to their scores. Different colors represent different score values. The convex portion of the surface indicates that a first-level variable corresponding to the policy has a higher score. Conversely, the concave portion of the surface indicates that a first-level variable corresponding to the policy has a lower score, and the policy needs to be further improved in this regard.

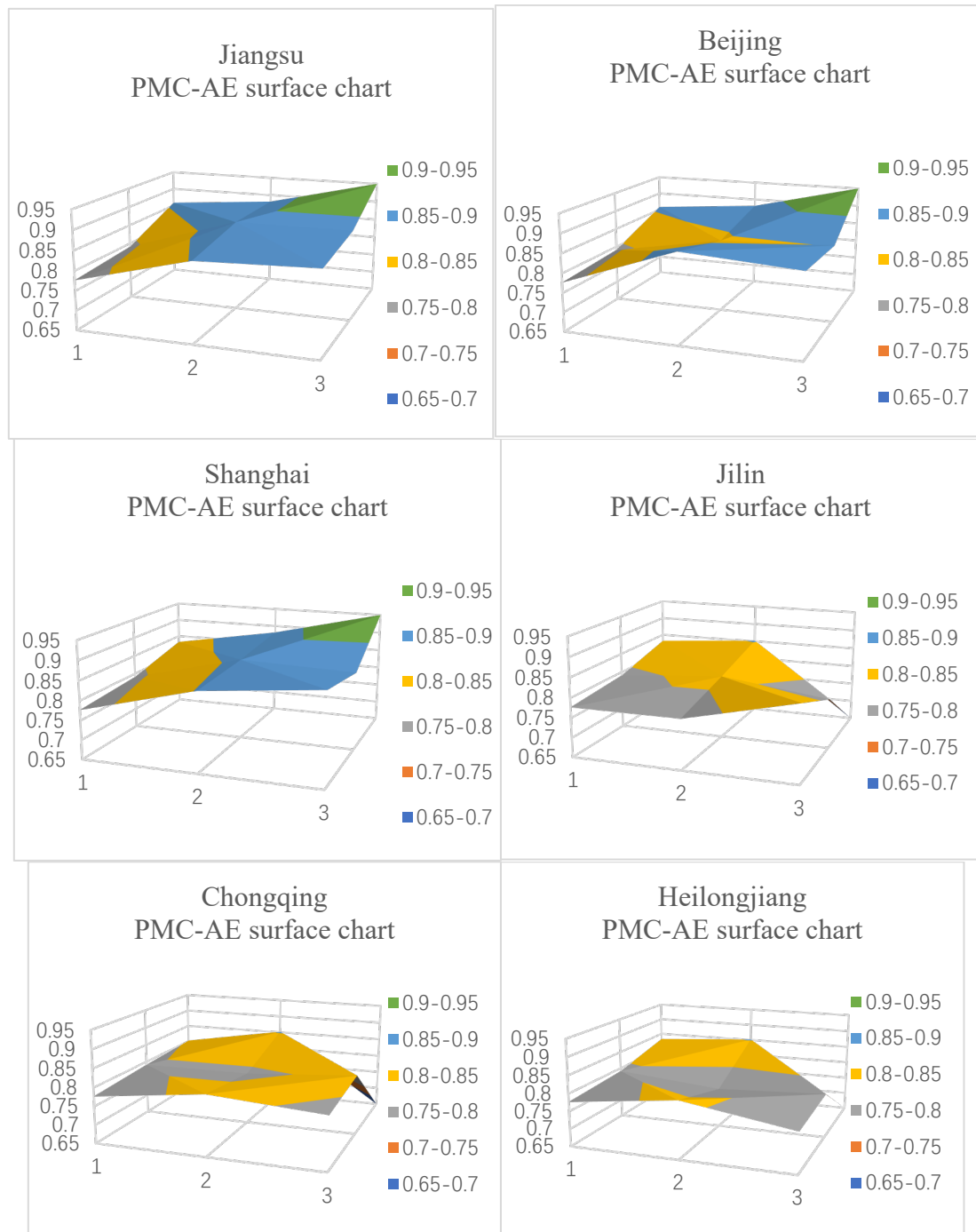


Figure 2: PMC-AE surface chart of compulsory education policies in each province (municipality)

## 4. Discussion

### 4.1 Overall analysis of Compulsory Education Policy in China

According to the score of PMC-AE index of compulsory education policy, it can be seen that the compulsory education policy implemented by various provinces in China is scientific and reasonable on the whole, and has already achieved a lot in the development of compulsory education.

(1) There are many types of compulsory education policies, most of which are short-term. Among the 60 policy samples collected, 17% are for plannings, 28% for schemes, 7% for methods, 38% for opinions and 10% for notification. It shows that there are many policies for plannings, schemes and opinions in compulsory education, and only a small part of the policies are methods and notifications. Planning policies are the planning of the overall development of compulsory education, which is highly authoritative, while scheme and method policies are more focused on specific implementation of policies promulgated by the state and have strong execution power. Opinion-type policies are more detailed and targeted policies that provide guidance on a specific policy. Meanwhile, the prescription of planning policies is generally more than 10 years, which is effective for a long time, while the prescription of measures and opinions is generally 1-5 years. For example, "Beijing's Measures to Further Alleviate the Burden of Students' Homework and Off-campus Training in Compulsory Education" belongs to the policy of measures. Beijing has issued this policy and planned to ensure that "double reduction" work has achieved remarkable results within two years.

(2) The compulsory education policy covers a wide range of target groups and has a prominent focus. In the research sample, 72 % of the samples have 3-5 policy audiences, among which 44% include schools, teachers and students at the same time. These policies focus on student development, teacher preparation, curriculum design, management and services. For example, "Implementation Plan for Further Reducing the Homework Burden and Off-campus Training Burden of Students in Compulsory Education in Anhui Province" is formulated for schools, students, teachers and off-campus institutions, so this policy focuses on both on-campus and off-campus aspects.

(3) Numerous guarantees and incentives are included in the policy of compulsory education. 85% of policies include clear responsibilities, supervision and inspection, and strengthened leadership, demonstrating how the government has improved the environment for learning and advanced the growth of compulsory education through an exacting management system. In contrast, "Notice on Further Reducing the Burden of Off-campus Training for Students in Compulsory Education" issued by Chongqing has a relatively simple incentive and guarantee mechanism. It only involves clear responsibility, supervision and inspection of the two means of management. The index value ranks lower in all policy samples.

(4) The overall structure of compulsory education policy is highly standardized. This research selects the policy samples issued by the provincial (municipal) government, which are based on the macro plan issued by the state or the spirit of an important conference. Therefore, most of the policies have clear goals and tasks, scientific and reasonable implementation plans, and detailed countermeasures. However, the policy structure of some notices and opinions is relatively simple, and there is no clear basis source and objective in the policy documents, which leads to the sketchy content planning and insufficient operability.

### 4.2 Analysis of Compulsory Education Policy in Provinces (Municipalities)

As can be seen from Figure 2, the surface area of compulsory education policy in Jiangsu, Beijing and Shanghai is larger than that in Jilin, Chongqing and Heilongjiang. It shows that the policy scores of Jiangsu, Beijing and Shanghai are relatively high, indicating that the policies promulgated by these provinces (municipalities) are generally perfect and the contents of the evaluated policy texts are well set. In contrast, the scores of compulsory education policies in Jilin, Chongqing and Heilongjiang are relatively low, indicating that the policies promulgated by these provinces (municipalities) are insufficient in some respects and need to be further improved.

The overall structure of Jiangsu province's compulsory education policy is standardized, with multiple policy features, broad policy audiences, and diverse policy roles, showing that the policy is reasonably sound. This is evident from the evaluation findings of each index. For instance, the Jiangsu Province Education Development Plan for the "14th Five-Year Plan" was created by the General Office of the Provincial Government to support the equitable and high-quality development of basic education.

It is anticipated that by 2025, educational system of Jiangsu Province will be more ideal, its level of modernization and overall strength will continue to be at the forefront of the nation, and its policy effectiveness will be prolonged. It can be seen from the policy text that the Policy Function (X6) includes 10 aspects, such as standardizing school-running behavior, creating high-quality professional and innovative teachers, promoting the high-quality and balanced development of compulsory education, and deepening the comprehensive reform of education. Policy Audience (X3) involves students, schools, teachers, parents. And the policy content is relatively detailed. Incentive-constraint (X7) adopted by Jiangsu policy samples are more comprehensive, such as "The Provincial Education Department and Other Four Departments about the All-round Services to Further Enhance the Level of Service after Class after Class of Primary and Secondary Schools of the Implementation Opinions". It is advocated to further improve the after-school service level of primary and secondary school students by strengthening organizational leadership, increasing investment in education, strengthening supervision and evaluation, and improving the implementation mechanism.

By observing the curves of compulsory education policies in Jiangsu, Beijing and Shanghai in Figure 2, and comparing the scores of each first-level variable, it is found that the differences mainly exist in the three first-level variables: Policy Duration (X1), Policy Type (X9) and Policy Focus (X5). Since the General Office of the State Council issued "Opinions on Further Reducing the Homework Burden and Off-campus Training Burden of Students in Compulsory Education" in July 2021, Beijing and Shanghai have issued short-term plans with the goal of "double reduction". For instance, "Beijing on Further Reduce the Compulsory Education Stage Student Work Burden and Off-campus Training Measures", "Shanghai Compulsory Education Stage Supervision Work Plan" and so on. Its purpose is to carry out precise policies around the work requirements of "unburdening". Policy types are mostly scheme-type and opinion-type, resulting in short-term policy development. The policy focuses on student development, with a small scope but strong pertinence. This shows that the score of policies depends on its own characteristics to a certain extent, and the optimization of policies can be started from the incentive guarantee measures. For example, strengthen the special supervision of "Double Reduction" work, and incorporate the inspection results into the annual performance appraisal, so as to improve the incentive effect of the policy.

The policy scores of Jilin, Chongqing and Heilongjiang are relatively low, and there is a big gap between them and Jiangsu Province, and there is a certain room for improvement. By comparing the curves of compulsory education policies in Jilin, Chongqing and Heilongjiang in Figure 2, it can be seen that Jilin is superior to Chongqing and Heilongjiang. Although there is little difference between Jilin and Chongqing in the final score, the scores of each variable are different. For example, in the index of Policy Nature (X2), Jilin is lower than Chongqing, and the policy nature does not involve suggestions and guidance, compulsory requirements, etc. In terms of the Policy Audience (X3) index score, Chongqing is lower than Jilin. Chongqing should consider all the objects involved in the policy formulation, including principals, out-of-school institutions, parents, etc. Policy samples taken in addition, two provinces means of Incentive-constraint (X7) is not comprehensive, such as "Notice of Jilin Province on Strengthening the Operation Management of Compulsory Education Schools", "Opinions of Chongqing Municipal People's Government on Coordinating the Reform and Development of Integrated Urban and rural Compulsory Education at District and County Level" only involves clarifying responsibilities and strengthening supervision and inspection, and lacks measures such as performance appraisal and capital investment. Therefore, it can be improved from the above three aspects when formulating policies in the future. It is suggested that the policy improvement order of Jilin Province should be  $X2 - X3 - X7$ , and that of Chongqing should be  $X3 - X7 - X2$ , which can be adjusted according to the actual situation.

The sample types of policies in Heilongjiang Province are mostly notices and opinions, such as the "Notice of Heilongjiang Province Compulsory Education Quality Evaluation Standard (Trial)", "Implementation Opinions of Heilongjiang Province on Comprehensively Improving Basic School Conditions for Rural Compulsory Education Weak Schools" etc. Due to the characteristics of the policy itself, the policy formulation time is short, the policy type is not comprehensive and other problems. In particular, it is necessary to improve the three aspects of Policy Audience (X3), Policy Focus (X5) and Policy Function (X6). The analysis of policy texts found that the sample compulsory education policies in this province only involved schools and teachers, failed to focus on student development, and ignored the improvement of in-school curriculum design, home-school collaborative education, compulsory education funding guarantee mechanism and other aspects. In terms of policy function indicators, there is no mention of "how to plan the layout of the school and standardize the school-running behavior" and "how to improve the overall level of the school teachers", and there are no specific requirements for measures. Therefore, the improvement direction of Heilongjiang compulsory education policy can be



started from taking various incentive measures, combining various policy functions, encouraging multiple parties to participate in the development of compulsory education and so on, in the order of  $X3 - X5 - X6 - X2$ .

## 5. Conclusion and Suggestions

Based on the methods of text mining and content analysis, this research analyzes the contents of 60 representative compulsory education policies published by various provinces in China from 2005 to 2022. The PMC-AE index model is used to construct the quantitative framework of compulsory education policy. The PMC-AE index is calculated and the curved graph is drawn. The top three and bottom three provinces (municipalities) are quantitatively evaluated and analyzed. The results showed that although the scores of 31 provinces (municipalities) are high or low, the overall difference is not large. Jiangsu, Beijing and Shanghai score high, while Jilin, Chongqing and Heilongjiang score relatively low. Reasons for low scores are not only related to the characteristics of the policy itself, such as the two indicators of Policy Type ( $X9$ ) and Policy Duration ( $X1$ ), but also mainly affected by the four indicators of Policy Audience ( $X3$ ), Policy Focus ( $X5$ ), Policy Function ( $X6$ ) and Incentive-constraint ( $X7$ ).

Based on the above evaluation results, the following suggestions are put forward for improving compulsory education policies:

Firstly, expand the target range of policy participation and guide various parties to promote the development of compulsory education. At present, the target of compulsory education policies in each province (municipality) is mainly students and teachers. To improve the quality of compulsory education needs joint efforts of many parties. Only paying attention to students' learning and teachers' teaching is insufficient. Therefore, the target group of compulsory education policy needs to be extended outward-especially after the "double reduction" policy is issued. All the targets such as schools, students, teachers, principals, parents and institutions outside school should be included in the policy formulation. For example, standardize the behavior of training service, improve the discipline training management service platform, enhance home-school contact, or build a harmonious home-school relationship. At the same time, all participants should actively cooperate with each other to implement the policy, and give timely feedback when encountering problems.

Secondly, give full play to the role of policies in improving the quality of compulsory education. Regularization of running school behavior and promoting the construction of teaching staff are an important entry point for the development of compulsory education. On the one hand, schools should act as the main role in education. Schools should co-ordinate teaching activities and teacher resources, strictly implement the curriculum plan, strengthen the management of school work to enhance the quality of education and teaching. On the other hand, teachers are the main body to promote the development of compulsory education. We will strengthen the management and training of teachers, and give full play to their principal role in regularization of running school behavior activities. Therefore, the government should pay attention to these two aspects of planning when formulating policies to ensure that the goals and tasks are implemented.

Thirdly, create a good atmosphere for the development of compulsory education. Most of the incentive-constraint measures adopted by current policies are to strengthen leadership, clarify responsibilities and supervision and inspection, while the measures of capital investment and performance appraisal are less. At the same time, the government should establish a scientific and reasonable supervision, monitoring and evaluation mechanism, and commend those who pass the inspection and acceptance through the way of performance appraisal, and hold accountable the departments and relevant responsible persons who cause adverse effects due to the inadequate implementation of the work, so as to comprehensively promote the development of compulsory education.

## 6. Prospects and Deficiencies

This study only digs, analyzes and evaluates the text content of compulsory education policies without considering the implementation of them, and the conclusion has certain limitations. In the future, an evaluation model can be established based on the implementation process and effect of the policy, so as to further study the effect of the implementation of the policy on compulsory education in provinces (municipalities) and carry out a more comprehensive study on the compulsory education policy.

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