

Temporal Evolution and Obstacle Analysis of the High-Quality Development of Primary School Education Conditions in Qinghai Province

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Abstract. This study establishes a comprehensive evaluation index system for primary school education conditions consisting of school premises, facilities, and teaching staff. Using the entropy weight method, it analyzes the development index of primary education conditions in Qinghai Province from 2013 to 2022. The obstacle degree analysis model is then employed to identify the major hindering factors. The results show that overall, the condition of primary education in Qinghai has been improving, yet displays two heterogeneous trends: “urban areas lag behind rural areas” and “rural areas progress more slowly than urban areas.” Based on this, the paper suggests that Qinghai should increase investment in primary education conditions, refine the allocation of educational resources, and prioritize the development of teaching staff.

Keywords: Primary Education, School Conditions, High-Quality Development, Quality and Equity, Qinghai

1. Introduction

The Plan for Building a Strong Educational Nation (2024–2035) proposes that by the year 2035, China will become a strong nation in education, achieving the comprehensive establishment of a high-quality education system. To realize this goal, the plan emphasizes the need to “promote the high-quality and equitable development of compulsory education and achieve urban-rural integration” [1].

Primary education serves as the strategic foundation of compulsory education. Its high-quality development is the cornerstone for achieving both equity and integration within compulsory education. Improving school conditions is a key focus in the effort to advance primary education quality. Therefore, addressing the conditions under which primary education is provided is an essential component in the overall planning for its high-quality development. Ensuring high-quality school conditions across urban, township, and rural areas within a province represents a foundational step toward the broader goals of building a strong province and a strong nation through education. Although China has made notable achievements in primary education in recent years, problems such as unequal resource allocation and the incomplete integration of urban and rural education remain prominent [2]. The path toward high-quality development of school conditions in

primary education still faces significant challenges. However, existing studies have primarily focused on macro-level research concerning the overall trajectory and strategic planning of national education development. There is a relative lack of analysis at the level of individual provinces, making it difficult to accurately reflect the distinctive practices and realities of education at the local level. Thus, there is an urgent need to shift the research focus to the provincial level. Doing so will allow for a more accurate understanding of the development status and obstacles facing primary education conditions in specific regions and enable the formulation of more targeted policy recommendations.

2. Research design

2.1. Research object

Qinghai Province, located in the northwest frontier region of China, is a key area for the implementation of the country's high-quality development strategy. Its development experience holds significant reference value for other border regions. In 2021, Qinghai successfully achieved basic equity in compulsory education and is currently in a critical transitional period toward high-quality equity. Therefore, studying the conditions of primary school education in the province is both relevant and timely.

2.2. Evaluation index system

The research team for the “Study on Standards for Balanced Development of Compulsory Education” at the Chinese Academy of Educational Sciences identified eight key indicators for assessing basic educational equity: Teaching and auxiliary room area per student; Sports venue area per student; Value of teaching equipment per student; Number of computers per 100 students; Number of books per student; Student-teacher ratio; Number of teachers with qualifications exceeding the basic requirement per student; Number of teachers with intermediate or higher professional titles per student [3]. These eight indicators are characterized by strong rationality, representativeness, and scientific validity, having withstood both time and practical application. Accordingly, this study constructs an evaluation index system for primary school education conditions based on the characteristics of these indicators, consisting of three primary indicators and eight secondary indicators (see Table 1).

Table 1. Evaluation index system for primary school education conditions

Target Layer	Primary Indicator	Secondary Indicator	Attribute	Weight
Primary Education Conditions	Site Conditions (X1)	Teaching and auxiliary room area per student (X11)	Positive	0.0839
		Sports venue area per student (X12)	Positive	0.1679
	Facility Conditions (X2)	Value of teaching equipment per student (X21)	Positive	0.1650
		Number of computers per 100 students (X22)	Positive	0.1133
		Number of books per student (X23)	Positive	0.1088
	Teacher Conditions (X3)	Student-teacher ratio (X31)	Negative	0.0509
		Teachers with intermediate or higher titles per student (X32)	Positive	0.1934
		Teachers with the required qualifications per student (X33)	Positive	0.1168

*Note: The weights were calculated using the entropy weight method described below.

2.3. Data sources and standardization

2.3.1. Data sources

The data were obtained from publicly available sources such as the China Education Statistics Yearbook, Qinghai Education Yearbook, education development bulletins, and the National Bureau of Statistics. Missing values were supplemented using the linear interpolation method.

2.3.2. Data standardization

Data standardization refers to the process of applying certain mathematical transformations to convert indicators with different physical meanings, units of measurement, and original scales into a unified scale for the purpose of comparison [4]. In this study, the range standardization method is adopted, with the following formulas:

$$Z_{ij} = \frac{x_{ij} - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad (1)$$

$$Z_{ij} = \frac{x_j^{\max} - x_{ij}}{x_j^{\max} - x_j^{\min}} \quad (2)$$

Where: Z_{ij} represents the standardized value of the j -th indicator for the i -th object; x_{ij} is the original data value of the j -th indicator for the i -th object; $x_j^{\max}$ and $x_j^{\min}$ are the maximum and minimum values of the j -th indicator across all observations.

2.4. Research methods

2.4.1. Entropy weight method

The entropy weight method is a widely applied objective weighting technique. It eliminates the subjectivity and arbitrariness often present in the process of assigning weights to indicators, thereby enhancing the credibility of the weighting results. This method is well-suited for comprehensive evaluations involving multiple indicators. In this study, the entropy weight method is used to calculate the weights of specific indicators within the evaluation index system for primary school education conditions in Qinghai Province from 2013 to 2022, as well as to compute the comprehensive development level of each evaluation object. The calculation steps are as follows:

- (1) Calculate the proportion of each standardized indicator value z_{ij} :

$$P_{ij} = \frac{z_{ij}}{\sum_{i=1}^n z_{ij}} \quad (3)$$

- (2) Calculate the entropy value for each indicator (where n is the number of evaluation objects):

$$E_j = -\frac{1}{\ln n} \sum_{i=1}^n P_{ij} \ln P_{ij} \quad (4)$$

- (3) Calculate the difference coefficient for each indicator:

$$G_j = 1 - E_j \quad (5)$$

- (4) Calculate the weight for each indicator (see Table 1), where m is the number of indicators:

$$W_j = \frac{G_j}{\sum_{j=1}^m G_j} \quad (6)$$

- (5) Calculate the comprehensive evaluation value for the high-quality development of primary education in Qinghai:

$$S_i = \sum_{j=1}^m W_j Z_{ij} \quad (7)$$

2.4.2. Obstacle factor method

This study applies the obstacle degree model to identify the key factors hindering the high-quality development of primary school education conditions in Qinghai and to measure the extent of each obstacle. The formulas used are as follows [5]:

- (1) Calculate the deviation of each indicator, i.e., the gap between the actual value and the optimal value:

$$V_{ij} = 1 - Z_{ij} \quad (8)$$

- (2) Calculate the obstacle degree of each indicator:

$$O_{ij} = \frac{W_j V_{ij}}{\sum_{j=1}^m W_j V_{ij}} \times 100 \quad (9)$$

3. Analysis of the current status of primary school education conditions in Qinghai province

3.1. Overall temporal evolution analysis

From 2013 to 2022, the comprehensive level of primary school education conditions in Qinghai Province has shown a steady upward trend (see Figure 1). The development index rose from 0.3230 in 2013 to 0.5687 in 2022—an increase of 1.76 times—demonstrating the strong commitment of both the national and provincial governments to improving education conditions in border regions. Year by year, the most significant improvement occurred between 2013 and 2017. In 2018, due to a sharp increase in the number of enrolled students at the primary level, several per-student indicators in the index system experienced a decline. However, the index resumed its upward trajectory in the following years. Previously, issues such as poor school conditions, challenging geographic environments, weak household economies, and outdated social attitudes led to significant dropout rates in some areas of Qinghai. In 2018, the province launched a large-scale campaign to reduce dropouts and ensure school attendance. That year alone, 27,000 students who had dropped out of compulsory education were persuaded to return (with a re-enrollment success rate of 98%). As a result, the retention rate for compulsory education in Qinghai rose from 94.21% in 2017 to 96.8%, achieving the national goal of 95% by 2020 ahead of schedule.

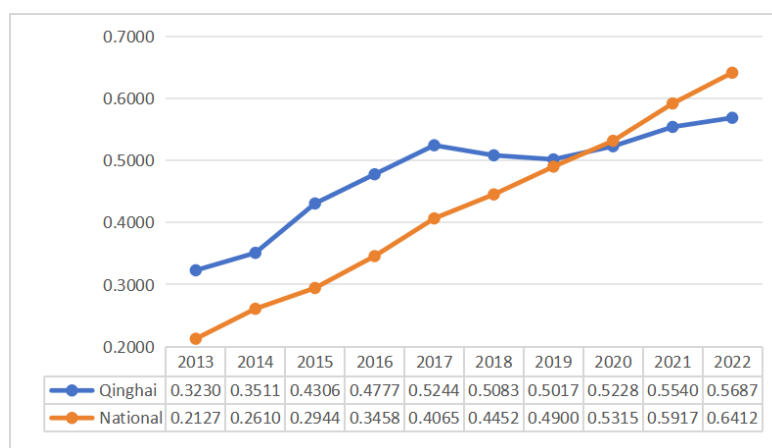


Figure 1. Comprehensive development level of primary education conditions in Qinghai province

With regard to regional development differences (see Figure 2), the hierarchy of primary school conditions among the three regional divisions in Qinghai (rural, urban, and township) consistently followed the order of “rural > urban > township” from 2013 to 2022. In terms of growth momentum, however, the trend was “urban > township > rural.” Over the ten-year observation period, the development index for primary school conditions increased by 2.02 times in urban areas, 1.98 times in township areas, and 1.69 times in rural areas.

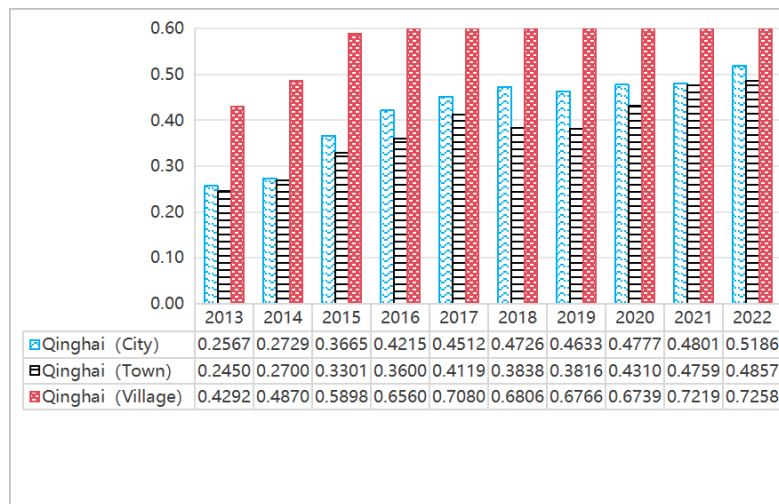


Figure 2. Comprehensive development level of primary school conditions in urban, township, and rural areas of Qinghai

3.2. Analysis of major obstacle factors

Between 2013 and 2022, the obstacle degrees of the three primary indicators of school conditions in Qinghai ranked as follows: X2 (Facility Conditions) > X3 (Teacher Conditions) > X1 (Site Conditions) (see Figure 3). The average annual obstacle degrees for the three categories were 0.3876, 0.3521, and 0.2604, respectively.

Among them, X2 (Facility Conditions) has been the leading obstacle in both past and present stages of development. However, its obstacle degree steadily decreased over the decade—from 0.5114 in 2013 to 0.2627 in 2022—indicating significant progress in improving school facilities. In contrast, the obstacle degrees of X1 (Site Conditions) and X3 (Teacher Conditions) showed fluctuating upward trends, rising from 0.2374 and 0.2513 to 0.2800 and 0.4573, respectively. This reflects the growing challenges Qinghai faces in terms of adequate school premises and teacher workforce construction. Notably, the obstacle degree of X3 increased by 1.81 times over the decade, making it the most significant current barrier to the development of school conditions, with the steepest rise among all primary indicators.

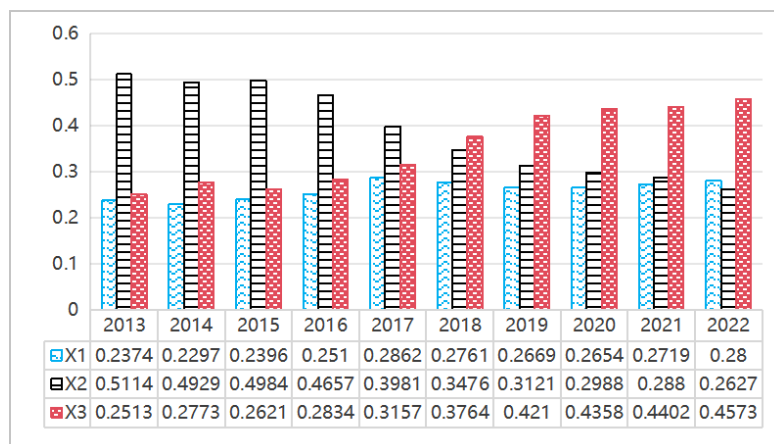


Figure 3. Obstacle degrees of primary school education condition indicators in Qinghai

In 2022, the regional comparison of secondary indicator obstacle degrees (see Figure 4) showed that indicators X11 (teaching and auxiliary space per student), X21 (value of teaching equipment per student), and X32 (teachers with intermediate or higher titles per student) were the main obstacles across both urban and township areas. For rural areas, the key obstacles were X12 (sports venue area per student), X21, and X32.

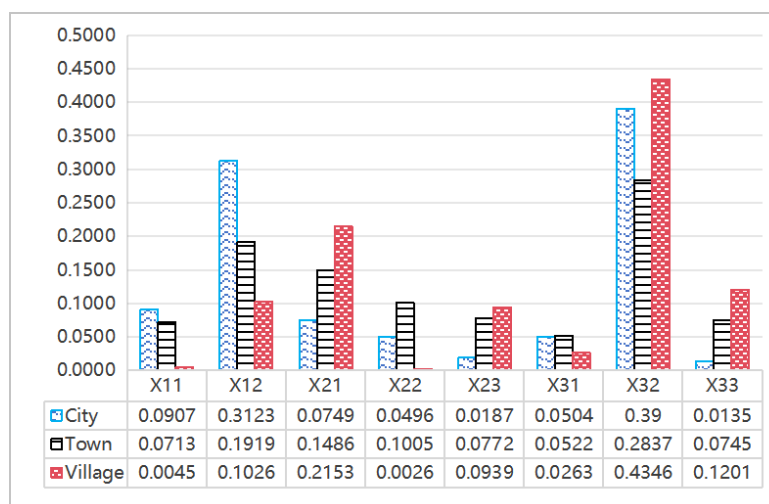


Figure 4. Obstacle degrees of secondary indicators in urban, township, and rural primary schools in Qinghai, 2022

From an inter-regional perspective in 2022, the top obstacle indicators were: In urban areas: X11 and X12 had the highest obstacle degrees. In township areas: X22 (computers per 100 students) and X31 (student-teacher ratio) ranked highest. In rural areas: X21, X23 (books per student), X32, and X33 (qualified teachers per student) had the highest obstacle degrees. The data indicate that teacher-related indicators are particularly problematic in rural areas, underscoring the relative weakness of the teacher workforce in those regions.

4. Conclusions and recommendations

4.1. Research conclusions

(1) At the provincial level, the development of primary school education conditions in Qinghai has shown a steadily rising trend with some fluctuations. The period from 2013 to 2017 saw the most rapid improvements, followed by a structural decline in 2018 and a subsequent continuous increase. Thanks to the province's remarkable achievements in dropout prevention and compulsory education retention around 2018, the trajectory of educational development may be described as "plain on the surface but rich in substance." Although there was a temporary dip, the foundation of primary education has become more solid. Among all dimensions, school facility conditions (X2) showed the most significant improvement, with standardized hardware and equipment providing a strong material basis for the high-quality development of primary education in Qinghai.

(2) In terms of regional comparison, the development of primary school education conditions across urban, township, and rural areas in Qinghai exhibits two heterogeneous characteristics: "urban lagging behind rural" and "rural progressing slower than urban." "Urban lagging behind rural" refers to the fact that the per-student level of school conditions in rural areas has long surpassed that in urban and township regions. This pattern results from both the sustained decline in

rural student populations and heightened attention at both the provincial and national levels to improving rural school conditions. From 2013 to 2022, the number of enrolled students in rural primary schools in Qinghai decreased from 191,418 to 156,162. At the same time, initiatives such as the Comprehensive School Renovation Project, the Education Quality Improvement Project, the Basic Public Education Services Guarantee Program, eastern Qinghai's paired support for southern Qinghai education, and interprovincial education assistance have significantly improved school conditions in rural areas, effectively addressing the “weak rural education” problem in the province. “Rural progressing slower than urban” refers to the faster growth rate of school conditions in urban areas compared to rural areas, reflecting Qinghai’s effort to adapt its primary education to the trends of new urbanization and population migration. From 2013 to 2022, as the urban population increased, the number of primary school students in urban areas rose from 283,220 to 361,158. In response, the province implemented initiatives such as large-class-size reduction plans, school district management reforms, group-based schooling, and joint review and approval systems for education land use. These measures have ensured sufficient urban educational land and school capacity, facilitating the construction of standardized schools and alleviating the “urban school crowding” problem.

4.2. Policy recommendations

(1) Align with demographic trends and increase investment in school conditions. In the context of national population aging, Qinghai’s child dependency ratio reached 29.2% in 2023, higher than the national average of 24.88%. This indicates a relatively healthy child population and continued potential for growth in basic education. The province should adjust its investments in line with changes in the school-age population, continuously increasing funding for primary education infrastructure to lay a solid material foundation for high-quality school conditions.

(2) Improve school governance efficiency and fine-tune resource allocation. Regional development imbalances are closely linked to differences in educational investment and the government's ability to allocate resources equitably. Qinghai should formulate targeted strategies in response to the heterogeneity of school condition development across regions. For instance, considering that urban primary schools face high obstacle degrees in site conditions, the province should, while ensuring that rural conditions do not regress, expand urban educational land in line with urbanization trends and accelerate the construction and renovation of primary schools to resolve the issue of “urban lagging behind rural.”

(3) Strengthen the teaching workforce to ensure a high-quality teacher supply. Teacher quality is a key determinant of educational outcomes. Given the persistently high obstacle degree associated with teacher-related conditions, especially in rural primary schools, Qinghai should implement the following five measures to enhance the supply of qualified full-time teachers: First, rely on local universities to expand the training of highly educated teachers in shortage subjects, addressing structural shortages in the teaching force [6]; Second, improve living allowances and welfare benefits for primary school teachers to attract high-level talent to the profession; Third, establish clear mechanisms for flexible promotion and exit, enabling “upward and downward mobility” in professional titles and “inward and outward flow” in employment to invigorate the teaching workforce; Fourth, develop and refine dynamic allocation mechanisms for teaching positions across urban-rural, grade, and regional boundaries to address structural shortages of full-time primary school teachers; Fifth, leverage interregional support and East-West collaboration programs to promote both academic advancement and talent cultivation for in-service teachers.

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