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A Cluster Analysis of Educational Development Disparities in Western China

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Abstract: Significant regional imbalances have long been observed in China's development, with the level of educational development in the western region consistently lagging behind the national average. Structural disparities are also evident among the provinces within the region. To systematically identify the determinants of these disparities and to characterize the spatial development patterns, a multidimensional evaluation framework was constructed using six indicators: number of schools, number of teachers, average years of schooling, public library collection size, governmental fiscal education expenditure, and number of internet users. Panel data from 12 western provinces (including municipalities and autonomous regions) for 2008 and 2017 were employed. Indicator weights were determined using the entropy method, followed by cluster analysis to classify the levels of educational development across the region. The findings indicate a steady overall improvement in educational development in western China, although substantial interprovincial disparities persist. Based on these results, policy recommendations are presented, including the optimization of the education policy system, improvement of resource allocation structures, strengthening of high-quality talent recruitment and incentive mechanisms, and coordinated planning of educational resources. The conclusions provide empirical support and policy guidance for enhancing educational equity and promoting balanced development in western China.

Keywords: Educational indicators; Cluster analysis; SPSS; Regional disparities; Educational policy

1. Introduction

China's vast territorial expanse has resulted in pronounced heterogeneity in natural conditions, historical and cultural contexts, and levels of socioeconomic development, giving rise to longstanding regional imbalances. Since 1978, the implementation of a non-balanced development strategy that prioritized the eastern coastal region has facilitated rapid economic growth; however, it has concurrently intensified disparities among regions. While this strategy accelerated national economic expansion, it also profoundly shaped the spatial allocation of educational resources, leading to marked divergences in educational development between eastern and western regions as well as between urban and rural areas. Persistent educational disparities not only conflict with the fundamental principles of social equity but also constrain national human capital accumulation and hinder sustainable social development. For an extended period, regional development disparities have been predominantly attributed by economists and sociologists to uneven economic growth. Nevertheless, regional imbalance is not solely an economic issue; rather, it is closely intertwined with the development of social sectors such as education. In western China, educational development has been significantly constrained by factors including a weak economic foundation, complex geographical conditions, and the presence of diverse ethnic cultures, resulting in levels of educational development that remain below the national average. Although substantial progress has been achieved since the initiation of the Western Development Strategy in 2000—particularly in the universalization of nine-year compulsory education—striking disparities persist both within the western region itself and between the western region and the more developed central and eastern regions. As a critical mechanism for breaking intergenerational transmission of poverty and fostering socioeconomic development, the balanced development of education across regions has become an urgent concern.

Against this backdrop, the promotion of educational equity and the optimization of the spatial allocation of educational resources—particularly the strengthening of educational development in the western region—has become a central objective of China's medium- and long-term education reform agenda. This objective bears directly not only on the healthy development of the education sector itself but also on national political stability, economic growth, and cultural vitality. Therefore, a systematic diagnosis of the underlying causes of educational disparities in the western region, along with the formulation of targeted policy responses, holds substantial theoretical significance and practical value. In this context, mathematical and statistical methods—specifically cluster analysis and comprehensive evaluation techniques—were employed in this study to classify the level of educational development across the western region, identify the key determinants of educational disparities, and propose strategies for reducing these disparities and advancing educational development. Research surrounding regional educational development and its equilibrium has been conducted extensively by scholars in China and abroad.

Multiple scholars have constructed multidimensional indicator frameworks to assess educational development across various stages and types of education. For example, Zhu et al. (2014) developed an indicator framework for higher education in the United States based on scale and fiscal dimensions and conducted a comprehensive assessment using factor analysis. Judijanto & Aslan (2025) explored ways to address disparities in education through a multisectoral approach, drawing on a review of international literature. Disparities in education, which are influenced by socio-economic, geographical, gender and physical ability factors, require holistic solutions that involve various sectors such as health, economy and society. The review emphasizes the importance of policies that not only focus on infrastructure and curriculum but also provide social and financial support for disadvantaged groups. In addition, sustainable and data-driven program planning is needed to identify the groups most in need of interventions and the types of interventions that are most effective. In the Special Issue from Nikolai et al. (2022) the paper addressed the described research gaps from different disciplines, including education sciences and sociology. The empirical studies encompass compulsory school, baccalaureate schools, vocational education and training, higher education, continuing adult education, and non-formal education. The paper focused on selected countries (Germany, Switzerland, England, Estonia, Spain, and Bulgaria) and the disparities in education at regional or even local levels. They analyzed origins, policies, and governance, as well as consequences of regional disparities within and between countries (Rivza et al., 2015). The results show that, first, HED in China shows regional linkage and hierarchical connection in high-value regions in the input and outcome dimensions. Second, the input dimension is still the leading factor restricting current HED in China. At the local scale, the geographical stratification characteristics of the four dimensions are evident. The restriction of the educational process covers a wide range and is concentrated in areas with the high-value regions of HED. The innovation of the research is the analysis of the geographical stratification of mechanisms, which identifies regional differences in the factors affecting HED in China. Kettunen (2004) analyzed the role of regional development in higher education using the approach of the balanced scorecard, which provides a framework for organizations to describe and communicate their strategy. It turns out that the balanced scorecard is not only an approach for implementing the strategy, but it also provides a general framework for evaluating the strategy from the different perspectives. The study presents examples where the new evaluation approach has been used to analyze the national educational policy of regional development, regional strategies of higher education institutions and their cooperation. According to the results of the study, cooperation between higher education institutions is most important from the perspectives of learning and regional development.

In recent years, extensive research has been conducted by numerous scholars (Gerhards, 2021; Jalaeian Bakhshande & Gholami, 2022; Juliani & Aslan, 2024; Maqsood et al., 2025; Rafiee et al., 2020; Rojak & Khayru, 2022; Sarı & Aypay, 2024; Sauvant, 2021; Sherraden et al., 2018; Sischarenco & Luomaranta, 2023; Paulsen & McCormick, 2020; Wiggins et al., 2020). However, several methodological and conceptual limitations remain evident upon closer examination of the existing literature. First, many studies have relied primarily on qualitative analysis or on a single quantitative indicator, resulting in the absence of multidimensional and systematic evaluation frameworks. Such methodological constraints may lead to partial conclusions and recommendations. Second, a large share of prior research has concentrated on specific stages of education—such as higher education or preschool education—while studies examining educational development from a regional perspective and comparing the overall level of comprehensive educational development across different regions remain relatively scarce. In light of these gaps, an analysis of the western region as an integrated whole was undertaken in this study. Panel data for 12 provinces, autonomous regions, and municipalities in western China for the years 2008 and 2017 were employed to construct a multidimensional comprehensive evaluation indicator system encompassing educational scale, resource investment, faculty development, and educational outcomes. Indicator weights were determined using the entropy method, and cluster analysis was applied to classify the levels of educational development across the region. Through the integration of quantitative analysis and qualitative interpretation, the regional differentiation patterns and underlying drivers of educational development in western China were examined, with the aim of providing a scientific foundation and policy reference for promoting balanced and sustainable educational development in the region.

2. Related Theory and Research Methodology

2.1 Theory of Unbalanced Development

The theory of unbalanced development, an essential component of the broader non-balanced development framework, was first proposed by economist Hirschman. The theory posits that developing countries and regions, constrained by limited resources, should concentrate these resources in key sectors or regions to stimulate priority development, thereby driving overall growth. Subsequently, scholars such as Perroux and Friedmann advanced the "growth pole" theory, conceptualizing regional economic development as a force field in which a growth pole functions as a central node that exerts radiating effects on surrounding areas. During this process, however, growth generates not only diffusion effects but also backwash effects. In the early stages of development in particular, more advanced regions often attract resources and factors of production from less developed areas, thereby widening regional disparities and reinforcing a Matthew Effect in which advantages accumulate and disadvantages intensify.

This theoretical framework exhibits strong applicability to the field of education. The allocation of educational resources follows a similarly unbalanced pattern, as high-quality teachers, financial investment, and superior educational conditions tend to cluster in a limited number of advantaged regions or institutions. Such concentration exacerbates disparities in educational development across regions and between schools. Empirical evidence from domestic and international research further demonstrates that the spatial and structural imbalance of educational resource allocation constitutes a major driver of educational disparities. Consequently, the theory of unbalanced development provides a powerful analytical lens for examining the underlying causes of regional disparities in educational development.

2.2 Comprehensive Evaluation Method

In earlier studies, some scholars adopted single indicators to represent the research object due to considerations of data availability and operational simplicity. However, such an approach is insufficient for capturing the complexity of multidimensional systems. With the development of comprehensive evaluation methodologies, their importance in empirical research has become increasingly prominent. Because comprehensive evaluation involves multiple indicators, the determination of appropriate indicator weights constitutes a critical step in the assessment process. In early applications, subjective weighting methods such as the Analytic Hierarchy Process (AHP) were widely employed. Nonetheless, these methods are prone to evaluator subjectivity and may introduce bias into the results.

By contrast, the entropy method, as an objective weighting approach, determines indicator weights based on the degree of variation inherent in the data itself, thereby offering stronger scientific rigor and reliability. The underlying principle is that indicators with greater variability possess lower information entropy and therefore contain more information; as a result, higher weights should be assigned to such indicators. This method effectively reduces the influence of human judgement and enhances the objectivity and accuracy of evaluation outcomes, making it particularly suitable for multidimensional and large-sample assessments of educational development.

2.3 Cluster Analysis Method

Cluster analysis constitutes an important branch of multivariate statistical analysis and is widely applied to automatic classification involving samples or variables. The method does not rely on prior knowledge; instead, classification is conducted objectively based on the similarity or affinity among samples. As a result, high similarity is maintained within each cluster, while substantial differences are preserved between clusters. Commonly used clustering approaches include the following:

- K-means clustering: This method is characterized by high computational efficiency, rapid speed, and conceptual simplicity, making it particularly suitable for large-scale datasets. Its primary limitation lies in the requirement that the number of clusters be predetermined.
- Fuzzy clustering: Grounded in fuzzy mathematics, this approach is applicable to the classification of qualitative variables or attributes and is capable of handling situations in which category boundaries are ambiguous.
- Agglomerative clustering: This method allows for flexible definitions of similarity measures and does not require a pre-specified number of categories; moreover, it facilitates the identification of hierarchical relationships among clusters. Nonetheless, hierarchical clustering is computationally intensive, sensitive to outliers, and may generate chain-like clustering structures.
- Hierarchical clustering: In this method, each sample is initially treated as an independent cluster. The two most similar clusters are then merged iteratively until all samples are combined into a single cluster. Although this approach provides a complete representation of the clustering process, the determination of the appropriate number of clusters must still be guided by empirical considerations.

3. Model Construction for Assessing Educational Development Disparities in Western China

A qualitative framework for the evaluation indicator system describing the level of educational development across the provinces, autonomous regions, and municipalities of western China was first established, and the detailed procedures for measuring educational development using the entropy method are subsequently presented. Thereafter, qualitative and quantitative approaches were integrated through the application of cluster analysis in statistics to quantify the disparities in educational development among the regions.

3.1 Construction of the Indicator System

The construction of the indicator system represents a critical step in evaluating the level of educational development in western China. Building upon prior research and aligning with the actual conditions of educational development in the region, six indicators were incorporated into the evaluation framework: number of schools, number of teachers, average years of schooling, public library collection size, governmental fiscal education expenditure, and number of internet users. In addition, to eliminate distortions arising from differences in administrative area and population size among provinces, autonomous regions, and municipalities, all absolute indicators were normalized, and their corresponding relative measures were used for evaluation. The structure of the indicator system and the processing methods applied to each indicator are presented in Table 1.

Table 1. Indicator system for evaluating educational development in western China

Target Level	Indicator	Processing Method
Educational development in Western China	Schools per unit area X_1 (schools/km²)	Total number of primary schools, junior secondary schools, senior secondary schools, secondary vocational schools, and regular higher education institutions divided by administrative area
	Teachers per unit area X_2 (persons/km²)	Total number of full-time teachers in primary schools, junior secondary schools, senior secondary schools, secondary vocational schools, and regular higher education institutions divided by administrative area
	Internet users per unit area X_3 (households/km²)	Number of broadband internet access users divided by administrative area
	Average years of schooling X_4 (years/person)	(Primary school enrollment × 6) + (Junior secondary enrollment × 9) + (Senior secondary enrollment × 12) + (Secondary vocational enrollment × 15) + (Higher education enrollment × 16) ÷ year-end population
	Public library collections per capita X_5 (volumes/person)	Total public library holdings divided by year-end population
	Governmental fiscal education expenditure per capita X_6 (yuan/person)	National fiscal education expenditure divided by year-end population

3.2 Evaluation Model for Assessing Educational Development in Western China

The entropy method determines indicator weights based on the degree of variability observed in each indicator, thereby facilitating an objective weighting process. In general, lower information entropy indicates greater variability, implying that the indicator contains more information; accordingly, a larger weight is assigned during evaluation. Based on the indicator system established in the preceding section, the entropy method was applied to measure the level of educational development in western China. The specific computational procedure is outlined in Steps 1–5 as follows:

Step 1: The indicator data *i* for region j are standardized ($1 \le i \le n$, $1 \le j \le m$) according to the following procedure:

$$x_{ij}^{*} = \begin{cases} \dfrac{x_{ij} - \min_i\left(x_{ij}\right)}{\max_i\left(x_{ij}\right) - \min_i\left(x_{ij}\right)} + 1 & x_{ij} \text{ as a positive indicator} \\ \dfrac{\min_i\left(x_{ij}\right) - x_{ij}}{\max_i\left(x_{ij}\right) - \min_i\left(x_{ij}\right)} + 1 & x_{ij} \text{ as a negative indicator} \end{cases} \tag{1}$$

Step 2: The entropy value of indicator *i* is computed according to the following expression:

$$e_i = -\frac{1}{ln\, m}\sum_{j=1}^{m}\left[\frac{x_{ij}^*}{\sum_{j=1}^{m} x_{ij}^*} ln\left(\frac{x_{ij}^*}{\sum_{j=1}^{m} x_{ij}^*}\right)\right] \quad (2)$$

Step 3: The divergence coefficient of indicator *i* is calculated:

$$g_i = 1 - e_i \quad (3)$$

Step 4: The weight of the *i*-th indicator is obtained as follows:

$$w_i = \frac{g_i}{\sum_{i=1}^{n} g_i} \quad (4)$$

Step 5: The overall educational development level F_j of city *j* is derived through weighted aggregation:

$$F_j = \sum_{i=1}^{n} w_i (x_{ij}^*) \quad (5)$$

3.3 Cluster Analysis Model for Educational Disparities in Western China

The evaluation results for 2008 were first imported into SPSS, after which the indicator data were subjected to standardization. Factor analysis was then performed on the standardized variables, and the resulting scree plot is presented in Figure 1. Subsequently, cluster analysis was conducted. The between-groups linkage method and squared Euclidean distance were adopted to generate the dendrogram and icicle plot shown in Figure 2 and Figure 3. The clustering results indicate that the educational development levels of the twelve provinces, autonomous regions, and municipalities in Western China in 2008 can be classified into three distinct categories.

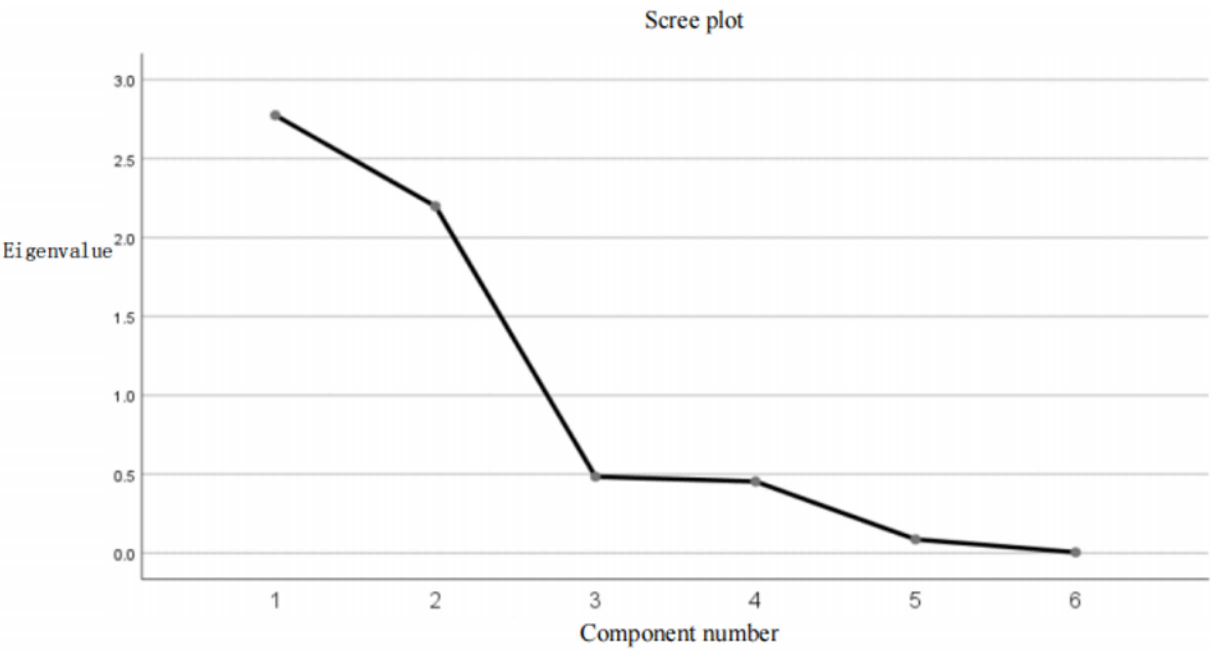

Figure 1. Scree plot

The first category consists solely of the Tibet Autonomous Region, which may be associated with its relatively underdeveloped economic conditions, as indicated by national statistical yearbooks. The second category comprises Qinghai, which exhibits the highest density of schools per unit area across the entire western region and a similarly prominent density of teachers. The third category includes Sichuan, Chongqing, the Guangxi Zhuang Autonomous Region, the Xinjiang Uygur Autonomous Region, Shaanxi, Gansu, the Inner Mongolia Autonomous Region, Yunnan, Guizhou, and the Ningxia Hui Autonomous Region. Across these provinces, the indicators of educational development display relatively small variations. Agglomeration schedule is presented in Table 2.

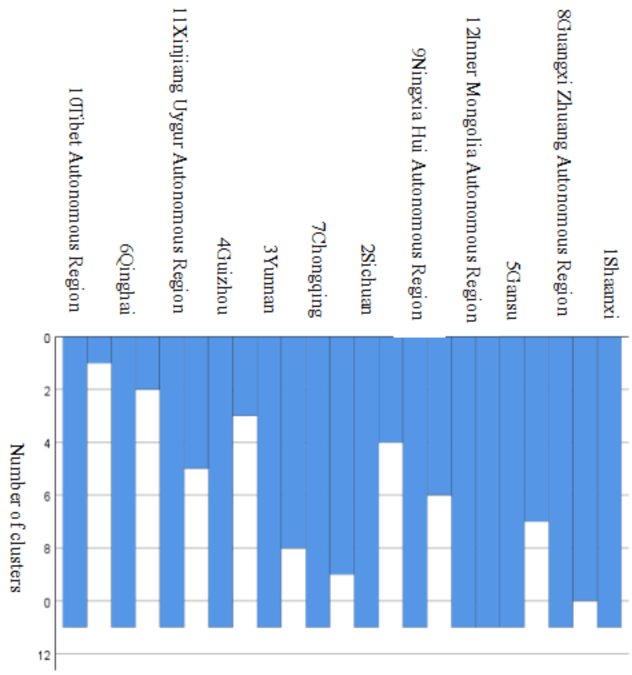

Figure 2. Number of clusters

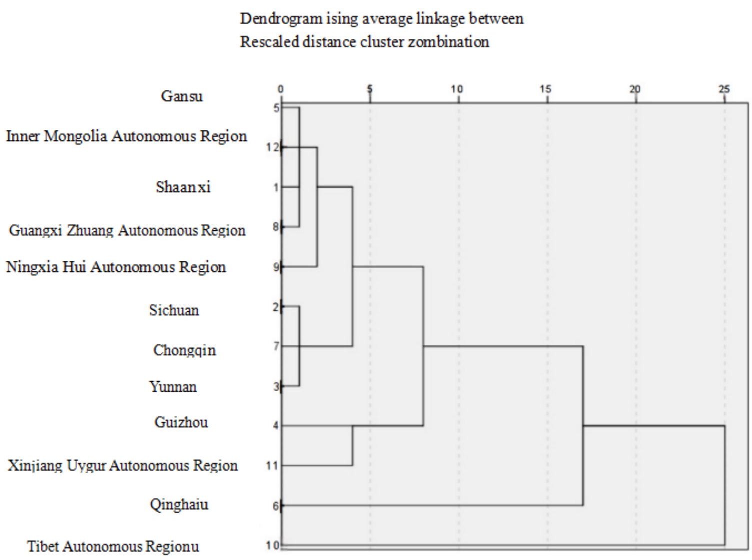

Figure 3. Dendrogram using average linkage

Table 2. Agglomeration schedule

Cluster Combination					First Appearance	Next Stage
Stage	Cluster 1	Cluster 2	Coefficient	Coefficient	Cluster 1	Cluster 2
1	5	12	0.109	0	0	5
2	1	8	0.124	0	0	5
3	2	7	0.638	0	0	4
4	2	3	0.897	3	0	8
5	1	5	1.106	2	1	6
6	1	9	1.824	5	0	8
7	4	11	4.632	0	0	9
8	1	2	4.694	6	4	9
9	1	4	9.611	8	7	10
10	1	6	20.245	9	0	11
11	1	10	31.485	10	0	0

After the 2017 dataset was imported into SPSS, the indicator variables were first subjected to standardization, after which factor analysis was applied to the transformed variables. The resulting scree plot is presented in Figure 4.

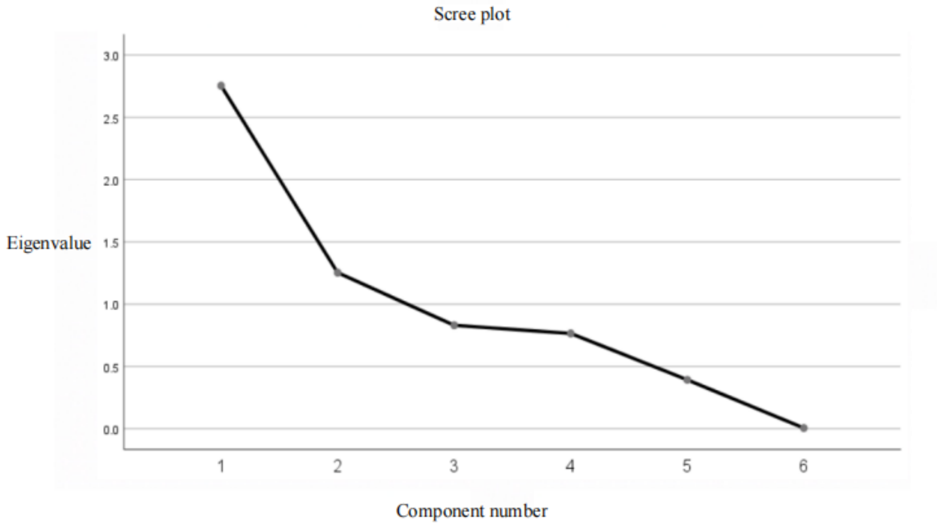

Figure 4. Scree plot

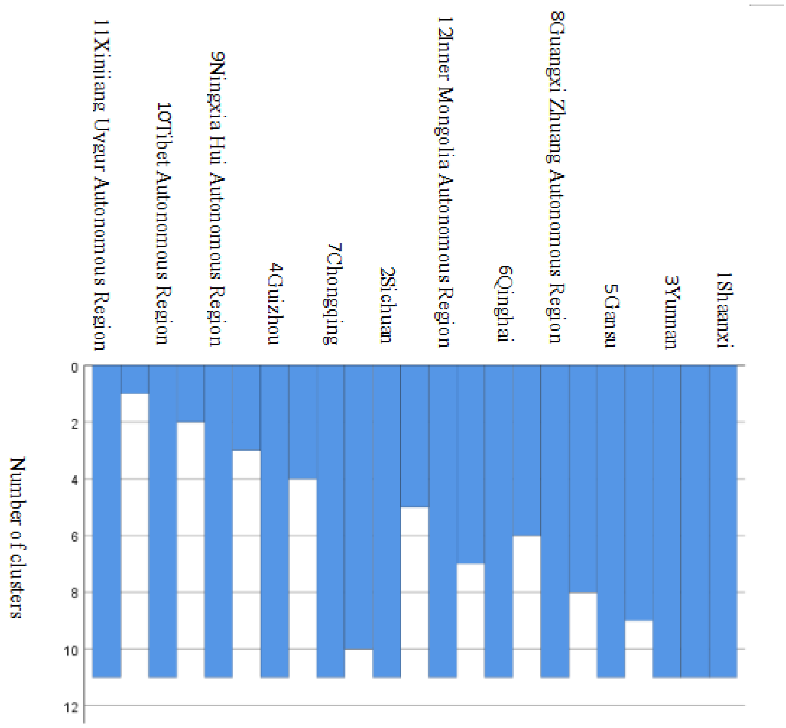

Figure 5. Number of clusters

Cluster analysis was subsequently conducted using the between-groups linkage method and squared Euclidean distance. The resulting icicle plot and dendrogram are presented in Figure 5 and Figure 6, respectively. When interpreted together with the scree plot, a three-cluster solution was identified as the most appropriate classification for the twelve provinces, autonomous regions, and municipalities in Western China in 2017. The first cluster consisted of the Xinjiang Uygur Autonomous Region, where the implementation of the Western Development Strategy and extensive support initiatives led to the highest density of teachers per unit area across the region. The second cluster consisted of the Tibet Autonomous Region. The third cluster comprised Shaanxi, Yunnan, Gansu, the Guangxi Zhuang Autonomous Region, Qinghai, the Inner Mongolia Autonomous Region, Sichuan, Chongqing, Guizhou, and the Ningxia Hui Autonomous Region. Agglomeration schedule is presented in Table 3.

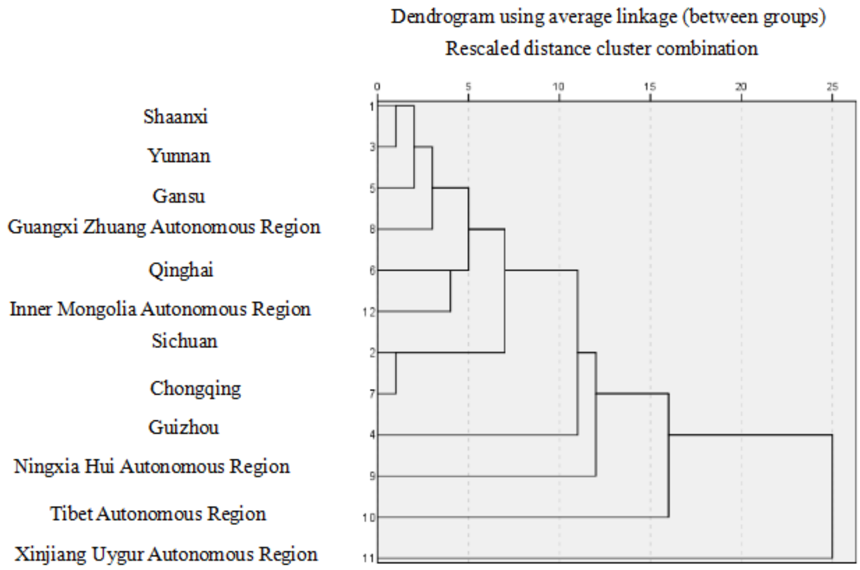

Figure 6. Dendrogram using average linkage

Table 3. Agglomeration schedule

Cluster Combination					**First Appearance**	**Next Stage**
Stage	Cluster 1	Cluster 2	Coefficient	Coefficient	Cluster 1	Cluster 2
1	1	3	0.53	0	0	3
2	2	7	1.409	0	0	7
3	1	5	1.54	1	0	4
4	1	8	2.771	3	0	6
5	6	12	3.783	0	0	6
6	1	6	5.273	4	5	7
7	1	2	7.423	6	2	8
8	1	4	11.211	7	0	9
9	1	9	12.145	8	0	10
10	1	10	16.187	9	0	11
11	1	11	25.705	10	0	0

4. Empirical Analysis of Educational Development Disparities in Western China

When the educational development levels of all provinces and autonomous regions in western China were classified, an excessively large number of categories was deemed unnecessary, whereas overly coarse groupings were also unsuitable. Based on the 2008 and 2017 datasets, the twelve provinces and autonomous regions were most appropriately classified into three categories. A comparative assessment of the classification results for 2008 and 2017 (Table 4 and Figure 7) indicated that the clustering structures derived for both years were reasonable.

It was observed that Tibet was consistently classified as a distinct category. Compared with other western provinces and autonomous regions, Tibet has faced persistent economic disadvantages, challenging living conditions, and relatively lagging educational development. Increased government investment in educational funding has therefore been essential for supporting educational advancement in the region. Between 2008 and 2017, national educational expenditure for Tibet increased from 4.21 billion yuan to 18.58 billion yuan, effectively strengthening the financial foundation for educational development and improving school infrastructure and service provision. Although Tibet's registered population increased from 0.48 million to 3.37 million during this period, the population size remained comparatively small within the western region, indirectly reflecting the negative effects of talent outflow on educational development. A comparison between the two years further indicated that, with the exception of Yunnan, Qinghai, and the Tibet Autonomous Region, most provinces and autonomous regions in western China experienced improvement in educational development levels. This pattern reflects the positive effects of the Western Development Strategy on regional education. The most substantial improvement was observed in Xinjiang. Multiple indicators demonstrated pronounced growth between 2008 and

2017: national educational expenditure allocated to Xinjiang increased from 19.17 billion yuan to 78.24 billion yuan; the total number of teachers rose from 267,214 to 314,273; and indicators such as the number of public libraries, total book collections, and internet access points also exhibited upward trends. These developments were driven by the implementation of national aid policies for Xinjiang and the "talent-driven education" strategy, which facilitated the introduction of high-quality personnel and strengthened educational development throughout the region. Tibet and Xinjiang are located at the periphery of the country and are relatively remote, and such locational disadvantages may partly constrain the pace of educational development.

Table 4. Educational development scores in Western China (2008 and 2017)

Region	Educational Development Score (2008)	Educational Development Score (2017)
Shaanxi	1.1462	1.2011
Sichuan	1.2282	1.3085
Yunnan	1.3059	1.1994
Guizhou	1.3544	1.3969
Gansu	1.0673	1.1450
Qinghai	1.6764	1.3244
Chongqing	1.2827	1.4040
Guangxi Zhuang Autonomous Region	1.1222	1.2593
Ningxia Hui Autonomous Region	1.1573	1.3447
Tibet Autonomous Region	1.4170	1.2431
Xinjiang Uygur Autonomous Region	1.4176	1.6547
Inner Mongolia Autonomous Region	1.0455	1.1282

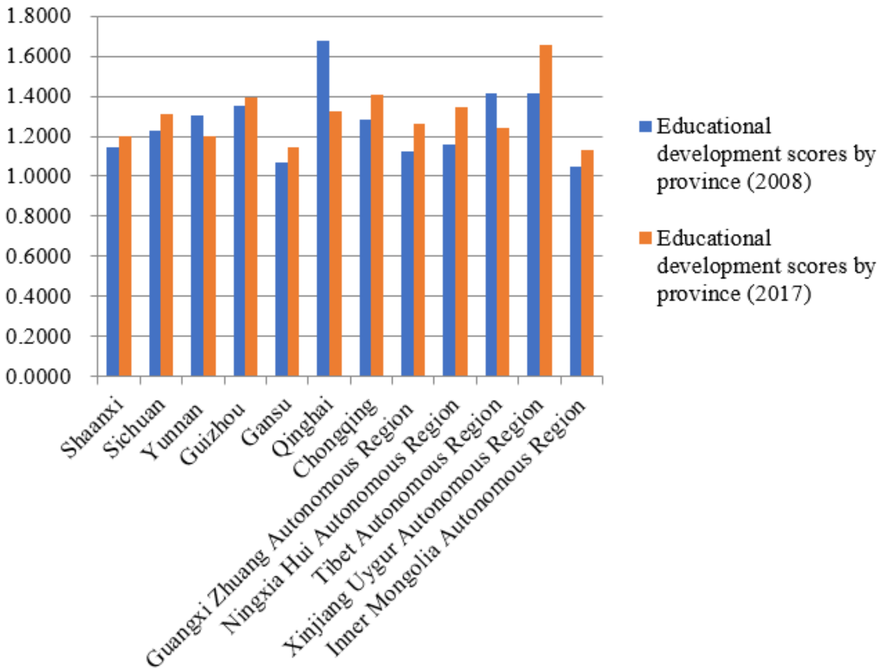

Figure 7. Educational development score histogram of Western China (2008 and 2017)

A decline in the educational development score was observed in Qinghai between 2008 and 2017, making it the only province-level region in western China that exhibited a pronounced downward trend during this period. According to the indicator set, the total number of schools decreased substantially from 3,094 to 1,180, while the size of the teaching workforce remained generally stable. At the same time, the registered population at year-end increased markedly from 0.48 million to 5.98 million. This shift indicates that, despite rapid population growth, the total stock of educational resources—particularly the number of schools and associated instructional facilities—did not expand proportionately, thereby intensifying pressure on resource provision. Although educational expenditure increased from 4.58 billion yuan to 21.63 billion yuan during the same period, and fiscal investment in education continued to grow, the overall level of educational development did not rise accordingly. This pattern suggests that the allocation structure, investment orientation, or utilization efficiency of educational funds may require further optimization, particularly concerning alignment with population mobility, shifts in the school-age population, and regional development needs. To obtain more robust evidence, it would be advisable to integrate indicators such as per-student expenditure, teacher allocation, and equipment renewal rates, and to employ input–output analysis or regression modeling to systematically evaluate resource allocation efficiency and its implications for educational quality. Such an approach would enable a more objective interpretation of the complex drivers underlying changes in educational development.

In contrast, Shaanxi, Yunnan, Gansu, the Guangxi Zhuang Autonomous Region, the Inner Mongolia Autonomous Region, Sichuan, Chongqing, Guizhou, and the Ningxia Hui Autonomous Region were consistently classified into the same category in both years. These provinces and autonomous regions demonstrated similar educational development scores and comparable growth rates, with relatively small differences across indicator values. Analysis of individual indicators shows that these regions have large and relatively stable population bases, with no substantial demographic volatility between 2008 and 2017. Teacher availability was considerably higher than in Tibet and Qinghai, and the introduction of qualified personnel has remained an important strategy for promoting educational development. The overall educational resource base in these regions was comparatively strong, with the number of schools, internet users, and other resource indicators far exceeding those of Tibet and Qinghai. From a geographical perspective, these provinces and autonomous regions occupy more advantageous locations than Tibet, Xinjiang, and Qinghai. Taken together, these findings indicate that a region's educational development level is fundamentally shaped by multiple interconnected factors, including the scale of educational expenditure, policy support for development, talent attraction capacity, geographical accessibility, and the prioritization of educational resource allocation.

5. Conclusions and Policy Implications

The disparities in educational development across regions are difficult to eliminate in the short term, indicating that the narrowing of these gaps constitutes a gradual process requiring sustained investment and long-term commitment. The advancement of education in western China must therefore be supported through continued strengthening of resource development and policy intervention. Although the overall educational development level in the western region improved between 2008 and 2017, pronounced intra-regional imbalances and limitations in overall competitiveness remained evident. For this reason, the strategic prioritization of education must be upheld, and the pace of educational development in the western region must be further accelerated.

From a practical perspective, several directions for policy intervention can be identified:

(a) Improving the educational policy framework to promote equitable resource allocation

The national education policy system should be further refined to enhance investment in the western region and to promote more rational and efficient allocation of educational resources. Increased support through central government transfer payments, dedicated education funds, and related mechanisms is recommended to prioritize resource allocation for disadvantaged areas in the western region, thereby advancing the goal of educational equity.

(b) Strengthening the recruitment and incentives for high-quality personnel

Enhanced incentive mechanisms should be established for high-quality personnel assigned to educational support roles in remote and underserved areas of western China. Preferential measures related to professional title evaluation, salary structures, and career advancement should be implemented to increase the attractiveness of such positions. Through these measures, the orderly flow of high-quality educational resources from the eastern region to the west can be encouraged, thereby establishing a stable and sustainable mechanism for talent provision.

(c) Coordinating the planning of educational resources and promoting balanced infrastructure development

Government departments at all administrative levels in the western region should strengthen the systematic planning and integrated allocation of educational infrastructure. Priority should be placed on improving essential school facilities, including classrooms, libraries, and digital learning environments. The reduction of intra-regional disparities in educational infrastructure would progressively alleviate the broader developmental imbalance between the western region and more advanced areas of the country.

It should be noted that certain limitations remain. Due to constraints in data collection and challenges in maintaining consistency in statistical standards across regions, the constructed indicator system may not fully capture the comprehensive level of educational development. Furthermore, limited data availability and the scope of current scholarly accumulation restrict the depth of some analytical components. The existing policy recommendations remain relatively macro-level; future work should integrate quantitative analytical results to formulate more differentiated and operational policy measures tailored to distinct sub-regions within western China—such as more developed urban centers, transitional developing areas, and impoverished remote regions.

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Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that they have no conflicts of interest.

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