The Imbalance and Optimization Path of China's Compulsory Education Resource Allocation under the Context of Low Birth Rate

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Abstract. Under the background of global population structure transformation, China's low birth rate has continued to intensify. Coupled with population mobility and urbanization, the total number of the school-age population in compulsory education has decreased and its structure has become differentiated, leading to an imbalance in resource allocation. This research focuses on the theme of optimizing the allocation of compulsory education resources in China under the backdrop of low birth rates, and adopts the method of literature review for analysis. The research reveals that the imbalance in resource allocation is manifested in the total idle redundancy, as well as the mismatch in urban-rural and educational stage structures. The root cause lies in the incompatibility between the dynamic changes in demand and the lagging adjustments in supply. Accordingly, this study proposes optimization pathways including differentiated layout, dynamic allocation of teachers, technology-enabled resource sharing, flexible supply, and clustered schooling, so as to provide theoretical and practical references for the scientific allocation of compulsory education resources.

Keywords: Low Birth Rate, Compulsory Education Resource Allocation, Resource Imbalance.

1 Introduction

The current global population structure is undergoing a transformation, with the phenomenon of low birth rates continuing to intensify. Low birth rate refers to a total fertility rate that is lower than the 2.1 level required for maintaining population replacement. As a large population country, the trend of low birth rate in China is also becoming increasingly prominent. The 2020 Chinese population census data shows that the total fertility rate in China has dropped to 1.3, and the scale of population migration has expanded dramatically, with the population living away from their registered permanent residence increasing by 88.52% compared with 2010. Since 2010, the number of births in China has been on a continuous decline. The urbanization rate has rapidly exceeded 60%, and the concentration of population in urban areas has further exacerbated the contradictions brought about by the changes in population structure [1].

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China's fertility rate has remained low for a long time, and the number of births has continued to decline, resulting in a decrease in the total number of the compulsory education school-age population after a period of time. From 2013 to 2023, the number of students in compulsory education in China showed a long-term downward trend [2]. The population reduction is not balanced between urban and rural areas, with the rural school-age population shrinking much faster than the urban population. Some rural schools are idle due to a shortage of students, while urban areas face a shortage of school places due to the influx of migrant children [2]. In areas with population inflows, the decline in school-age population is slow or even partially increases, while in areas with population outflows, it continues to decrease, which puts pressure on the dynamic allocation of resources [3].

In this context, the problem of imbalanced and insufficient allocation of compulsory education resources has become prominent, with low birth rates and large-scale population mobility exacerbating regional resource imbalances.

Existing research - in the past, the academic community mostly studied resource layout based on stable population size - although it has involved the balanced allocation of educational resources and the relationship between population and education, the dynamic adjustment of resources has not received sufficient attention, making it difficult to adapt to current population changes [1]. Thus, it can be seen that under the changes in population trends, research on optimizing compulsory education resources should be dynamically adjusted based on population changes.

Taking into account the problems and research gaps mentioned above, this study focuses on the optimal allocation of compulsory education resources in China under the background of low birth rates, analyzes the challenges and paths of resource allocation under dual pressures, and explores how to achieve dynamic adaptation and precise layout of resources in the context of population dynamics. This study adopts the literature research method to summarize relevant research findings, providing theoretical and practical references for the scientific allocation of compulsory education resources during the population transition period.

2 The Relationship between China's Low Birth Rate and the Allocation of Compulsory Education Resources

The phenomenon of low birth rate has disrupted the original balance of supply and demand for compulsory education resources by reshaping the scale and distribution of the school-age population. The demand side is showing a dynamic contraction and differentiation trend around the school-age population, while the supply side is constrained by the inherent attributes and institutional constraints of resources, resulting in insufficient flexibility in adjustment. The adaptation contradiction between the two constitutes the reason why the low birth rate affects the allocation of compulsory education resources.

2.1 Matching of Supply and Demand for Compulsory Education Resources

The matching of supply and demand for compulsory education resources is centered on the school-age population. The changes in the school-age population directly affect the scale, structure, and regional distribution of the demand side. The total amount rises or falls with the size of the school-age population, while the structure shows different manifestations with the flow of population between urban and rural areas and regional agglomeration [4]. Under the background of the low birth rate, demand has shifted from past scale expansion to a state of total contraction and structural differentiation. The demand for compulsory education in rural areas continues to decline, while local demand peaks have formed in areas with concentrated urban migrant children.

On the supply side, the government plays the leading role and abides by the principles of equality and fairness, and by taking fixed standards such as the student-teacher ratio and land area per student as the basis for resource allocation, a comprehensive supply system that includes school distribution, teacher assignment and infrastructure construction has thus been set up [5].

2.2 The Impact of Low Birth Rates on the Supply of Compulsory Education Resources

The impact of the low birth rate on compulsory education resources is essentially a structural mismatch caused by rapid changes in demand and lagging supply adjustments [4]. The lag in supply adjustment is due to the difficulty in modifying hardware resources such as school buildings and sports fields once they are built, which becomes a sunk cost and cannot be quickly adjusted with the decrease of students. And the approval and employment of teacher staffing are controlled by administrative processes, and teacher adjustments cannot keep up with changes in student size [6].

The overall imbalance is an important influencing factor. The declining birth rate has led to a continuous decrease in the school-age population and will result in a serious surplus of compulsory education resources in the long run. It is estimated that by 2050, there will be an excess of about 6.337 million full-time teachers and 3361.4 square kilometers of school land nationwide, and a large number of sunk resources will be difficult to reuse, thus causing inefficient idleness [4].

Structural contradictions are another factor. The low birth rate has further exacerbated the imbalance between education supply and demand. In rural areas, there are idle school buildings and redundant teachers, while in urban areas, there is a contradiction between the shortage of old school places and the vacancy of some newly-built school places [7]. The difficulty in adjusting resources ultimately leads to a decrease in the efficiency of educational resource allocation in the context of a low birth rate, and undermines educational equity [1].

3 Realistic Impact of the Low Birth Rate on Compulsory Education Resource Allocation

3.1 Imbalance in the Overall Allocation of Resources

The low birth rate has led to a reduction in the total school-age population, coupled with urban-rural mobility differentiation, which has disrupted the long-term balance between the supply and demand of compulsory education resources.

The continuous outflow of school-age population from rural areas and the overall decline have led to the continuous expansion and regional concentration of idle school buildings. In 2025, the number of idle school buildings in rural areas nationwide has reached about 40000, and it is expected to exceed 50000 by 2032, with an average annual growth rate of about 1244 [8]. The rural problems in western China are more prominent, and the number of local rural students is expected to significantly decrease from 2024 to 2040, with some provinces experiencing a decline of over 35%. School buildings face the risk of long-term idleness [9].

The idleness of school buildings is not only reflected in the quantity, but also in the inefficient utilization and waste of the hardware facilities. The number of students in rural primary and secondary schools has significantly decreased, and the school buildings and supporting facilities that were originally fully utilized have been idle for a long time. The utilization rate of laboratories, multimedia classrooms in small-scale rural schools is generally below 30% [8].

At present, the determination of teaching staff allocation in China mainly relies on the student-teacher ratio. However, this standard is insufficient to cope with the dynamic changes in the school-age population brought about by the low birth rate. The imbalance of the student-teacher ratio is mainly manifested in the redundancy of the total number of teachers, which has become a core factor restricting the quality of rural education. The average student-teacher ratio in small rural schools in central and western China has fallen to a mere 8.2:1, well below the national standard of 19:1, with some small village-level schools even facing notable overstaffing [10].

3.2 Mismatch in the Structure of Educational Resources

The combination of low birth rate and urbanization has led to the one-way migration of school-age population to urban areas, resulting in a severe imbalance between supply and demand of educational resources in urban and rural areas. At the urban level, the population siphon effect has led to local shortages of school places, which are particularly evident in popular schools in developed eastern regions and provincial capitals in central and western China, where class sizes in some areas commonly exceed 55 students and even reach more than 70 in extreme cases [11].

The continuous loss of school-age population in rural areas has driven schools to rapidly develop towards small-scale development, forming a vicious cycle of fewer students, more idle resources, and poorer quality. From a long-term perspective, the urbanization rate of the school-age population in primary and junior high schools has

been continuously rising, and the trend of small-scale rural schools has become irreversible [12]. Due to difficulties in resource integration and imbalanced teacher structure, small-scale schools find it difficult to improve their teaching quality, and the gap with urban schools continues to widen, further exacerbating the issue of educational equity.

The changes in the age structure of the school-age population brought about by the low birth rate have led to different characteristics in the supply and demand of resources for primary and junior high schools. During the primary school stage, due to the continuous decline in the birth rate, the problem of resource surplus emerged first, and it was particularly prominent in rural areas [13]. This reduces the efficiency of resource utilization, makes it difficult to ensure the comprehensive development of rural students, and further widens the education gap between urban and rural areas.

During the junior high school stage, the fluctuations in supply and demand are more complex. Affected by the mobility of the school-age population, the balance of supply and demand is difficult to maintain stably, and there are significant regional differences. Junior high schools in areas with population inflow are facing a shortage of local school places, and excessive class sizes are affecting teaching quality, while areas with population outflow are experiencing resource idleness due to a continuous decrease in student sources [11]. These long-term fluctuations in supply and demand pose challenges to the allocation of compulsory education resources.

4 Paths and Practices for Optimizing Compulsory Education Resource Allocation

4.1 School Layout and Idle Resource Utilization

The adjustment of school layouts should be based on the dynamic distribution of the school-age population and adopt differentiated strategies to avoid indiscriminate school closures. In rural areas, efforts should focus on precisely ensuring the operation of small-scale schools, retaining necessary teaching points, and strengthening boarding facilities to compensate for the lack of family education. Advance planning in urban areas, through reasonable expansion to alleviate degree pressure and avoid resource waste. The revitalization of idle resources is an important supplement to the optimization of the layout. Idle school buildings in rural areas can be transformed into public service facilities such as kindergartens, senior schools, and rural libraries, serving the cause of rural revitalization [12].

4.2 Teacher Deployment and Structure Optimization

The allocation of teaching staff should resolve the contradiction between overall redundancy and structural shortage, and establish an elastic adaptation mechanism. Teacher staffing approval abandons the single student-teacher ratio standard. Considering class size, grade span, curriculum design and other factors, an integrated system combining basic, flexible and supplementary staffing will be established, with resource allocation

tilted toward rural under performing schools and boarding schools. Implement the county-level staffing rotation pool system to coordinate and allocate teaching resources within the region.

Establish a sound mechanism for teacher mobility and protection, and promote inter-school rotations between urban and rural areas through the county-managed-school-appointment system. Incorporate the experience of teaching in rural areas into the considerations for career advancement and benefits subsidies, thereby alleviating the one-way flow of high-quality teachers. Strengthen the retraining of redundant teachers and the rehiring of experienced teachers, improve the treatment and career development channels for rural teachers, and enhance the attractiveness of the positions. East Germany effectively addressed the sharp decline in primary school enrollment through small class teaching and flexible teacher allocation strategies [14]. This experience provides important reference for the overall allocation of teachers at the county level in China.

4.3 Digital Resource Sharing and Balanced Development

Based on digital technology, a cross-regional shared network is established to integrate teaching staff, courses and equipment resources. Through remote teaching, synchronous classrooms and other forms, students in small-scale rural schools can simultaneously enjoy high-quality teaching resources from urban areas, effectively improving the quality of education in rural areas and promoting the balanced development of urban and rural educational resources.

Strengthen the deep integration of technology and teaching, promote the digitization of high-quality educational resources, and achieve inclusive supply. To address the shortage of teaching equipment in remote areas, digital teaching tools can be coordinated and allocated to improve hardware utilization efficiency through a shared platform, thereby narrowing the urban-rural educational gap with technology and providing new support for balanced resource allocation.

4.4 Flexible Supply and Cluster School Operation

Establish a mechanism for adjusting demand and adapting resources according to the dynamic changes in the school-age population. Promoting the modular construction of schools and reserving flexible space enables regions with population inflows to rapidly expand their schools, while areas with population outflows can transform idle school buildings into community education centers or care places for left-behind children. Implement dynamic management of teacher staffing and regional turnover, balance the urban-rural and inter school teacher structure through cross school rotation, and attract retired teachers and industry talents to supplement the teacher shortage. A dynamic funding allocation mechanism tied to the size and structure of the school-age population will be established, with dedicated funds set up to support resource redistribution and school facility renovation [3].

Promote the cluster education model, with high-quality schools as the core, and integrate surrounding urban and rural schools [13]. Integrating small schools, building

shared facilities, and working with other schools can solve the lack of resources in each school [15]. Unified planning of teaching staff within the educational cluster, achieving teacher balance through teacher rotation and joint teaching and research. Coordinate funding and hardware resources, build shared function classrooms and practical bases, and avoid unnecessary investment.

5 Conclusion

The research has found that the phenomenon of low birth rate has altered the size and distribution of the school-age population, disrupting the original supply-demand balance of compulsory education resources and triggering allocation conflicts. The reduction in the school-age population has led to a continuous expansion of the scale of idle school buildings in rural areas of China. The utilization efficiency of the hardware facilities is low, and even cases of aging and damage have occurred. The imbalance between teachers and students leads to an excess of teachers in total, and this problem is particularly prominent in small-scale rural schools in the central and western regions of China. The phenomenon of low birth rate and urbanization have combined, resulting in a polarized distribution of resources between urban and rural areas in China. Urban schools are experiencing a shortage of school places, while rural schools tend to become smaller in scale, creating a vicious cycle. There are distinct characteristics among different educational stages. During the primary school stage, a resource surplus emerges, while in the junior high school stage, the supply and demand is subject to population mobility, resulting in frequent fluctuations.

In response to the aforementioned contradictions, this study proposes an optimization approach, which includes basing on the dynamic changes of the school-age population, implementing differentiated adjustments to school layouts, and revitalizing idle resources. Establish a flexible and adaptable system for dynamic allocation and structural optimization of teaching staff. Build a cross-regional resource sharing platform relying on digital technology. Build a flexible supply mechanism and cluster-based education model that follows the demand for resources. The significance of this research lies in that it can provide theoretical references for the scientific allocation of compulsory education resources during China's population transition period, and promote educational equity and sustainable development.

The study has certain objective limitations. It mainly adopts literature analysis and lacks empirical data support. It also has insufficient analysis on countermeasures for different regions. In the future, empirical research and case studies can be carried out to further optimize the allocation of compulsory education resources.

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