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Original Article

Technological Resources, Teacher-Student Ratio Differences, and Educational Inequality Between Urban and Rural Areas in China

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Abstract

Introduction: Educational resource inequality between urban and rural areas remains a critical issue in achieving educational equity. This study focuses on the disparities in access to technical resources and teacher-student ratios in schools across Eastern China, aiming to examine their causes and impacts on educational quality and social development. **Methods:** Using data collected from 32 junior high schools and 7 primary schools, this study employs a combination of field surveys and questionnaire analysis. Quantitative methods are applied to compare urban and rural schools in terms of technical equipment, internet access, intelligent teaching resources, and teacher-student ratios, and to assess their influence on education quality. **Results:** The findings reveal that urban schools demonstrate significant advantages in resource allocation, characterised by lower teacher-student ratios, higher teacher qualifications, and richer technical resources. In contrast, rural schools face substantial resource shortages, which exacerbate educational disparities and hinder equitable development. Grounded in human capital theory, this study highlights the critical role of equitable resource allocation in enhancing human capital accumulation, improving education quality, and fostering balanced social and economic development. The findings underscore the necessity of increasing resource allocation to rural schools and optimising urban-rural resource distribution. Future research should expand sample coverage and incorporate diverse regions and school types to further investigate the multifaceted causes of educational inequality and propose actionable solutions. **Conclusion:** Urban schools demonstrate significant advantages in the allocation of educational resources, while rural institutions face severe shortages in these fundamental provisions. Specifically, the unequal distribution of technological resources and disparities in student-teacher ratios constitute primary drivers exacerbating urban-rural educational inequality.

***Keywords**: China; Educational Disparities; Resource Allocation; Rural Education*

Introduction

Educational resource allocation plays a crucial role in shaping social equity and regional development. With the further development of China's compulsory education and the implementation of the strategy of rejuvenating the country through science and education, the supply system of basic education resources has been continuously improved, the overall education level of residents has been significantly improved, and the illiteracy rate has continued to decline (Yu, Zhu & Baležentis, 2017). However, due to the long-term existence of the urban-rural dual economic structure, there is still a structural problem of "emphasizing cities and undervaluing rural areas" in the allocation of educational resources (Rao & Ye, 2016; Hannum, 1999). Urban educational resources have obvious advantages, while rural educational resources are relatively insufficient, especially in the acquisition of technical resources and teacher-student ratios. Although the state continues to introduce policies to support

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rural education, the inequality of educational resources and access to education in urban and rural areas has not been fundamentally improved. The unbalanced allocation of urban and rural educational resources not only affects the realisation of educational equity but also restricts the accumulation of rural human capital and the coordinated development of regional economies to a certain extent, which greatly affects the progress of the whole society.

Educational inequality matters for a few reasons. The uneven distribution of education means that the underutilisation of potential human capital will lead to huge social welfare losses (Thomas, Wang & Fan, 2001). But there are many factors that contribute to educational inequality. Based on Gary Becker's human capital theory (Weiss, 2015), this study points out that the investment in educational resources, especially in access to technical resources and teacher-student ratios, has a critical impact on the accumulation of human capital of students and teachers (Sun *et al*., 2018). And boost economic growth by improving the quality of education. Through investment in education, the human capital of students and teachers can be accumulated and improved, which not only improves the quality of education but also lays the foundation for long-term economic growth. The fair allocation of educational resources, especially the appropriately tilted input for disadvantaged areas (Kan *et al*., 2022), is of great significance for realising human capital accumulation and promoting social equity.

At present, there have been studies on urban and rural education inequality, but few in-depth studies on the structural causes and far-reaching effects of education inequality from the perspective of access to technical resources and teacher-student ratio differences in urban and rural schools. This study aims to fill these research gaps with the following specific objectives:

1. ***Analyse the differences in technology acquisition of urban and rural schools***: Through a questionnaire survey and empirical analysis, explore the differences in technology equipment, Internet access, intelligent teaching resources and other aspects of urban and rural schools, and assess the specific impact of these differences on education quality and teaching effect.

2. ***Compare the teacher-student ratio between urban and rural schools***: By analysing the teacher-student ratio of schools in different regions, this paper reveals its impact on teaching quality, classroom management and students' learning outcomes. Especially in rural schools with relatively scarce resources, a large teacher-student ratio has a negative impact on education results.

3. ***Discuss the impact of unequal allocation of educational resources on educational equity***: From the two dimensions of technology acquisition and teacher-student ratio, analyse the restrictive effect of unequal allocation of urban and rural educational resources on the realisation of educational equity, especially how it affects students' learning opportunities and development potential in rural areas.

4. ***Put forward policy suggestions***: Based on the empirical research results, put forward policy suggestions on promoting the equity of urban and rural education, optimising the allocation of educational resources and improving the quality of rural education to provide a theoretical basis and practical guidance for the government and relevant departments in the redistribution of educational resources, rural education support and education policy adjustment.

By comparing the differences between urban and rural schools in terms of technology acquisition and teacher-student ratio, this study aims to explore the substantive impact and mechanism of urban and rural education inequality, to provide data support and theoretical basis for policy formulation, and to provide an academic reference for achieving balanced distribution of educational resources and equitable social development.

Literature Review and Research Hypotheses

In modern society, educational inequality is an important research issue of social stratification. When economists first looked into educational inequality, they used the idea of income inequality as a guide and the Gini coefficient to figure out how unequal the distribution of school years was (Castelló & Doménech, 2002; Morrisson & Murtin, 2009; Thomas, Wang & Fan, 2001). Studies on educational

inequality can be traced back to the perspective of equality of educational opportunities proposed by Brown (1921), Lauderdale & Vance (2024), and Newton (1940). They believe that educational inequality is unequal access to education. Featherman and Hauser (1978) further advanced Mare's (1981) research and argued that no matter how many educational opportunities are increased in the process of educational scale expansion, the educational inequality between classes will remain unchanged before the dominant class reaches saturation (Newton, 1940). Only when the demand of the advantaged class is saturated are the rest the educational opportunities of the lower middle class (Raftery & Hout, 1993). This phenomenon is summarised as "Maximally Maintained Inequality in education," that is, the MMI hypothesis (Zhang *et al*., 2022).

As is shown in Figure 1, there is a gap between urban and rural education in China in many aspects. The urban-rural inequality in China's education development has deep social and economic roots (Li & Xue, 2022; Nikolaidis, 2023; Lu, Li & Zhou, 2024). As the most important family background factor, household registration has been a concern. The household registration system divides people into agricultural and non-agricultural sectors, and this system is closely related to welfare distribution, which widens and widens the gap between urban and rural residents in public services such as education (Fu & Ren, 2010; Hannum, 1999). Most studies show that rural students' relatively weak economic capital, cultural capital and social capital affect their educational attainment (Luo, Guo & Li, 2021). The relatively advantaged classes living in urban areas have more educational opportunities and high-quality educational resources, while the disadvantaged rural groups are often excluded (Yang, Huang & Liu, 2014). Hannum & Meiyan (2006) found that urban areas characterised by socialised production had better-funded and higher-quality education systems than rural areas characterised by smallholder production.

With the rapid development of information technology, access to technical resources has become a key factor in improving the quality of education (Acheampong *et al*., 2024). There is a close relationship between access to technology and the gap between urban and rural areas. Digital resources can improve the efficiency of information access, while users in backward areas will find it difficult to enjoy the benefits of information technology in education (Chao & Yu, 2016). Park (2017) discusses the application of technology from the perspective of urban-rural gap and finds that technology in rural areas is difficult to give full play to its advantages, and it increases the gap in education level between urban and rural areas. Digital inequality will hinder the flow of information resources, and this inequality will exacerbate the imbalance in the distribution of urban and rural resources (Yu, Lin & Liao 2017).

The teacher-student ratio is an important index to measure the allocation of educational resources, which directly affects the teaching quality and the learning effect of students. A higher student-teacher ratio means that each teacher is able to focus on a larger number of students, which affects classroom management, teaching interactions, and the handling of individual student differences. Yang, Huang & Liu (2014) found that there were always more college-educated teachers in cities than in rural areas. As a result, students from urban areas have access to a relatively high-quality education, have a better chance of advancing to the next level of education, and demonstrate better overall achievement in education.

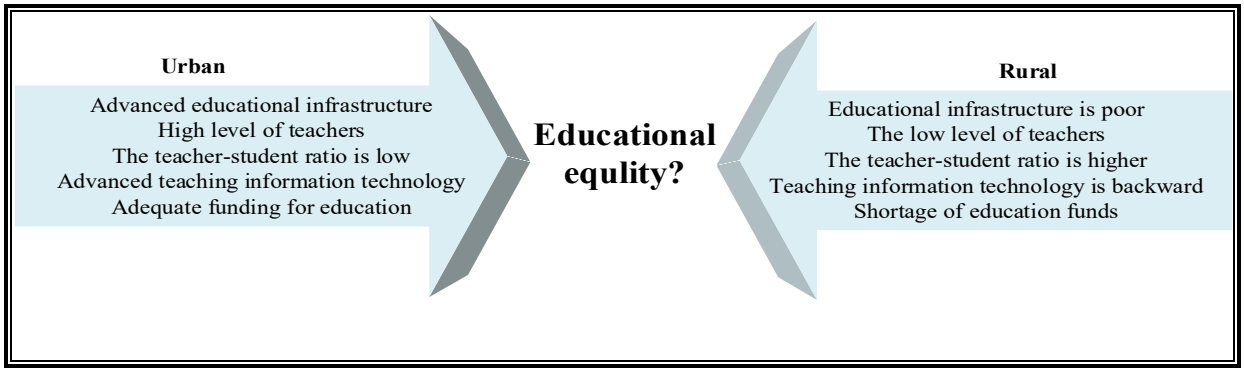

Figure 1: Education Gap Between Urban and Rural Areas

Methodology

Sample and Data Collection

Using a questionnaire survey, expert interviews, literature and so on. Thirty-two middle schools and seven primary schools in eastern China were selected as samples. In the middle school part, stratified sampling was adopted, and 2 middle schools were selected from each of the 16 districts and counties. 7 primary schools were randomly selected. Fifteen teaching and research staff from districts and counties were selected for interviews, including 7 teaching and research staff from urban areas and 8 teaching and research staff from townships. Questionnaires were conducted on the samples, and the distribution and recovery of questionnaires were shown in Table 1. Of the 2450 questionnaires issued, 17 were deemed invalid due to serious missing information, unclear answers or clear patterns of answers. 2433 valid questionnaires were retained, with an effective response rate of 99.3%.

Table 1: Questionnaire Distribution and Recovery

Survey Object	Issue Questionnaires	Recall Questionnaires	Recovery Rate	Invalid Questionnaires	Effective Rate
Teacher (Part)	110	95	86.4%	0	100%
Student (Part)	2340	1975	84.4%	17	99.1%

Sample Analysis

Rural-Urban Difference in Teacher-Student Ratio

From the perspective of teachers, the sample school has a total of 34,743 students, and the existing faculty and staff are 2064, with a teacher-student ratio of 1:17. From the comparison of urban and rural areas, the ratio of teachers to students in urban areas is 1:11, and that in rural areas is 1:24. This shows that teachers in cities and towns have been overstaffed, while teachers in villages are seriously insufficient. In remote areas, the practice of "one division, one school" or "two divisions, one school" persists. In these schools, the teacher-student ratio can be as high as 1:62, and there is a difference between rural and urban areas. Urban areas get more educational funds, which makes them better than rural areas in terms of work, life, children's education, and welfare. The result is that on the one hand, "the formal teachers who were originally in the countryside continue to choose to leave the countryside and enter the town in the interest game, resulting in a large number of formal teachers in the countryside" (survey quotes); on the other hand, "college graduates are reluctant to work in the countryside" (survey quote). This has led to a serious shortage of teachers in rural areas.

Urban-Rural Differences in Access to Technology

Using "number of computers used in teaching" and "vitality ratio" as indicators to measure technology acquisition, this method can directly quantify the level of school investment in information teaching resources to directly reflect the difference in the allocation of educational technology resources in urban and rural areas (Lu, Li & Zhou, 2024). As an important carrier of modern education, computers in teaching have become a key tool to improve teaching quality and student learning efficiency. The vitality ratio, as a standardised indicator, has strong comparability among schools of different sizes. This index system can clearly show how the digital divide affects educational inequality, especially when it comes to the unequal distribution of educational resources between cities and rural areas.

Table 2: Differences Between Urban and Rural Areas in The Number of Computers and The Vitality Ratio

	Number of Teaching Computers		Vitality Ratio	
	Urban	Rural	Urban	Rural
Junior high school	113.73	40.47	26.5861	58.2616
Primary school	90.10	31.35	18.4890	38.4731
Population mean	101.92	35.63	22.5375	48.0482

As can be seen from Table 2, in general, the number of "teaching computers" in urban schools (101.92) is significantly higher than that in rural schools (35.63). Specifically, in junior middle schools, the number

of "teaching computers" in urban middle schools (113.73) is significantly higher than that in rural middle schools (40.47). In terms of the number of "teaching computers" in primary schools, urban primary schools (90.10) were significantly higher than rural primary schools (31.35). In terms of "vitality ratio," urban schools (22.5375) were significantly lower than rural schools (48.0482), specifically: in terms of "vitality ratio" of junior middle schools, urban middle schools (26.5861) were significantly lower than rural middle schools (58.2616); urban primary schools (18.4890) were significantly lower than rural primary schools (38.4731).

Model Design

The ordinary least square method was used to estimate the impact of urban and rural technology acquisition and teacher-student ratio on education inequality (Nachbauer, 2024). The model was set as follows:

$$Y_i = \beta_0 + \beta_1 TechGap_i + \beta_2 TSRatioGap_i + \gamma X_i + \varepsilon_i \; Y_i$$

Y_i stands for educational inequality, which is measured by the gap between urban and rural enrolment rates. Specifically, the gap between urban and rural enrolment rates is chosen to measure educational inequality (that is, the difference between urban and rural enrolment opportunities). β_0 is the intercept term, β_1 and β_2 are the core explanatory variables, namely, the urban-rural technology acquisition gap (*Tech Gap*) and the urban-rural teacher-student ratio difference (*TSRatioGap*), β_3 is the coefficient of the control variable, and ε_i is the error term.
Specifically, the core explanatory and control variables are shown as follows:

1. Urban-rural Technology Access Gap (TechGapi)

It represents the urban-rural technology access gap and measures this gap by the difference in the number of computers used in teaching (ΔC). There is a significant disparity between urban and rural schools in terms of investment in information technology, particularly in the allocation of teaching equipment (such as computers) and network resources. The formula is as follows:

$$\Delta C = C_{urban} - C_{rural}$$

2. The Ratio Difference Between Urban and Rural Teachers and Students (TSRatioGapi)

The rural-urban teacher-student ratio difference is another key explanatory variable in this study, which reflects the distribution of teacher resources in different regions. Due to the imbalance in teacher resources between urban and rural areas, urban schools usually have a lower teacher-student ratio, while rural areas generally have a higher teacher-student ratio due to teacher shortages. This is measured in the following ways:

$$\Delta R = \left(\frac{Teachers_{urban}}{Student_{urban}} \right) - \left(\frac{Teachers_{rural}}{Student_{rural}} \right)$$

3. Control variables (X_i)

To further control other factors that may influence education inequality, the model also introduces the EduFundingGap, a measure of the difference in education funding between urban and rural areas. Teacher Education Gap: This variable measured the difference in teacher education levels between urban and rural areas. The educational level of teachers is closely related to the quality of teaching. Teachers with higher education usually have higher teaching ability and better utilisation ability of educational resources.

Results

Descriptive Statistics

Table 3 presents descriptive statistics and correlation analysis of each variable. The minimum value of education inequality is 0.05, and the maximum value is 0.50, which shows that the distribution of the urban-rural education gap is very different in different regions. The gap in technology resources between urban and rural schools (with an average of 25 teaching computers) indicates that digital

teaching equipment in rural school's lags significantly behind that in urban schools. This gap may directly affect rural students' opportunities to receive modern education. The average gap between the rural-urban teacher-student ratio is 0.13, indicating that the allocation of teachers in rural areas lags significantly behind that in urban areas. Combined with the existing literature, this gap may lead to insufficient learning guidance opportunities for rural students and further exacerbate the inequality of urban and rural education quality. The huge difference in education funding between urban and rural areas (average 10,000, maximum 25,000) is one of the important reasons for the lack of technical resources and teachers.

Table 3: Descriptive Statistics and Correlation Analysis

Variables	Mean	Minimum	Maximum	Median
Educational inequality	0.25	0.05	0.50	0.23
TechGap	25.00	5.00	60.00	22.50
TSRatioGap	0.13	0.03	0.30	0.12
EduFundingGap	10000	3000	25000	9500
TeacherEduGap	0.35	0.10	0.80	0.33

Regression Result Analysis

The results show that the urban-rural technology acquisition gap and the teacher-student ratio difference have a significant positive impact on education inequality, and the impact degree is relatively significant. Specifically, every unit increase in the rural-urban technology access gap will increase the level of educational inequality by 0.25 units, and every unit increase in the rural-urban teacher-student ratio gap will increase educational inequality by 0.18 units. This finding indicates that the unequal distribution of technical resources and the difference in the number of students per teacher are the main things making education inequality worse in both urban and rural areas. This is especially true in rural areas, where there are not enough resources or teachers. As control variables, the education funding gap and the teacher education gap also have significant effects on education inequality. Every unit increase in the gap of education funds increases the level of educational inequality by 0.45 units, while every unit increase in the gap of teachers' education credentials increases the level of educational inequality by 0.30 units. This shows that the relative adequacy of urban education funds and the difference in teachers' educational levels are important factors affecting the quality and equity of education.

Table 4: Regression Analysis of Education Inequality, Urban-Rural Technology Acquisition Difference and Teacher-Student Ratio Difference

Variables	Coefficient Estimates	Standard Error	*T*-Value	Significance
Intercept term	0.55	0.10	5.50	***
TechGap	0.25	0.05	5.00	***
TSRatioGap	0.18	0.04	4.50	***
EduFundingGap	0.45	0.12	3.75	***
TeacherEduGap	0.30	0.10	3.00	**

Discussion

The findings of this study underscore persistent disparities in technological resources and teacher-student ratios between urban and rural schools in China, aligning with recent scholarship on structural educational inequalities. The urban-rural divide in technology access, exemplified by the significant gap in teaching computers and digital infrastructure (Lu, Li & Zhou, 2024; Wang *et al*., 2024), mirrors broader patterns of spatial inequality observed in developing contexts. Zahl-Thanem & Rye (2024) and emphasise that such resource gaps amplify cognitive and skill-based disparities, as rural students lack exposure to modern pedagogical tools critical for 21st-century competencies (Sun *et al*., 2024). This aligns with human capital theory, wherein unequal investments in educational resources hinder equitable human capital accumulation, perpetuating intergenerational cycles of disadvantage (Weiss, 2015).

The pronounced teacher-student ratio imbalance further exacerbates educational inequities. Urban schools' lower ratios facilitate personalised instruction, consistent with Guo & Li's (2024) findings that teacher density directly correlates with academic outcomes. In contrast, rural schools' high ratios strain classroom management and limit individualised support, a phenomenon exacerbated by systemic underfunding and teacher attrition (Xiang & Stillwell, 2023). Nikolaidis (2023) argues that such structural imbalances reflect epistemic injustice, where marginalised populations face systemic barriers to accessing quality education.

Moreover, the vitality ratio disparity highlights rural schools' reliance on outdated pedagogical methods, contrasting with urban institutions' integration of intelligent teaching resources. This digital divide not only affects immediate learning outcomes but also limits rural students' long-term competitiveness in labour markets, as noted by Lu, Li & Zhou (2024). Collectively, these findings reinforce the urgency of reallocating resources to address spatial and institutional inequities, ensuring that educational investments align with principles of equity and social justice.

These findings highlight critical policy and theoretical implications for addressing educational inequality in China. One key takeaway is the necessity of bridging the tech interventions; improving teacher student ratios in rural schools should be a primary focus. Recruiting and retaining qualified educators in these areas remains a logical divide between urban and rural schools. While urban schools leverage advanced digital tools to enhance student engagement and learning outcomes, rural schools continue to struggle with outdated infrastructure and limited ICT integration. Policymakers should prioritise largescale investments in digital resources for rural education, ensuring that students have access to modern learning platforms and interactive pedagogical tools. Training teachers to effectively incorporate these resources into their instruction is equally essential to maximise their impact (Zhao *et al*., 2022).

In addition to technological challenges due to financial and infrastructural constraints. Incentives such as competitive salaries, professional development opportunities, and enhanced living conditions may help attract and retain skilled teachers in rural communities (Wang, 2021). Additionally, hybrid teaching models that blend online instruction with in-person support could help mitigate the teacher shortage and enhance the learning experience for rural students (Sun & Zhang, 2023).

The interplay between technological access and teacher-student ratios underscores the complexity of educational inequality. While urban schools benefit from both digital advancements and smaller class sizes, rural schools experience a compounded disadvantage. This dual challenge necessitates a comprehensive approach, incorporating both technological and human capital development. Blended learning approaches, where technology supplements traditional instruction, could offer a viable solution for rural settings with constrained teacher availability (Cheng & Smyth, 2021).

From a theoretical perspective, these findings extend the applicability of human capital theory and epistemic injustice frameworks in the context of educational inequality. Unequal resource distribution perpetuates disparities in human capital accumulation, limiting social mobility for rural populations. Future research should examine the long-term effects of digital interventions on rural education and explore comparative strategies adopted by other nations facing similar disparities.

Addressing educational inequality between urban and rural schools in China requires targeted policy measures that address both technological and instructional disparities. By ensuring equitable access to educational resources, fostering teacher retention in rural areas, and integrating digital tools effectively, China can create a more inclusive and just educational system.

Limitations

This study focuses on technical resources and teacher-student ratios, overlooking other critical aspects of educational inequality, such as curriculum quality, extracurricular opportunities, and parental involvement. Additionally, reliance on surveys and self-reported data may introduce biases, which could be mitigated through triangulation with secondary data sources, such as government statistics. Furthermore, the study has some limitations, particularly its reliance on a single data source from a sample of schools in the eastern region, which may restrict the generalizability of the findings.

Conclusion

This paper, which focuses on 32 junior high schools and 7 primary schools in eastern China, systematically explores the disparities and underlying causes of urban-rural education inequality, with particular emphasis on the teacher-student ratio and technology acquisition. The results show that urban schools outperform rural schools in both areas, as reflected in lower teacher-student ratios, higher teacher qualifications, more teaching computers, and a lower vitality ratio. These findings suggest that urban schools possess significant advantages in the allocation of educational resources, while rural schools face substantial shortages of these essentials, thereby exacerbating the urban-rural education divide.

The study highlights the urgent need for targeted policies to bridge the gap in educational resources between urban and rural areas. While government initiatives have made progress in improving rural education, fundamental disparities persist, requiring a more strategic approach to resource distribution. Increasing investments in teacher training programs, enhancing access to technology, and implementing incentive programs for educators in rural areas could significantly improve educational outcomes. Furthermore, reducing the urban-rural education divide is not only essential for achieving educational equity but also for fostering balanced regional development. The accumulation of human capital in rural areas plays a crucial role in economic and social progress and ensuring equal access to quality education is key to breaking the cycle of disadvantage. Future research should explore the long-term impact of policy interventions and assess the effectiveness of different resource allocation models to develop more sustainable solutions for educational equality.

Future research should expand the sample to include schools from other regions and incorporate diverse data sources to enhance the external validity of the conclusions. Additionally, future studies could explore a broader range of factors contributing to educational inequality and utilise multiple reporting sources to obtain a more comprehensive understanding of the issue. Future research should expand the regional scope, integrate longitudinal designs, and include broader dimensions of inequality to deepen understanding and improve the robustness of findings.

Conflicts of Interest

The authors declare that they have no conflict of interests.

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