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Institutional Adaptation and Educational Equity: A Case Study of Fiscal Transfers in Guangdong Province

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Abstract

Background and Aim: In China, provincial-level fiscal transfers are intended to reduce educational disparities across counties, yet their effectiveness has been inconsistent. This study examines Guangdong Province as a case to explore how transfer payments influence educational equity, particularly in light of limitations in existing frameworks such as the "formula-neutral" theory in fiscal federalism, which assumes standardized transfers can balance efficiency and fairness, and the multilevel governance paradigm, which often overlooks provincial-local dynamics. To address these gaps, this research proposes a new institutional framework that incorporates local governance capacities and socio-cultural contexts.

Materials and Methods: A mixed-methods approach was employed to investigate how fiscal transfers are implemented and interpreted at the county level. Quantitatively, the study used a difference-in-differences (DID) model on panel data from 2015–2022 to assess policy impacts. Qualitatively, policy document analysis and semi-structured interviews with local officials were conducted in 15 diverse counties. Special attention was given to ethnic minority regions, where local cultural practices influence the use of funds.

Results: The analysis revealed significant regional variation in how transfers affect equity. In the Pearl River Delta (PRD), increased population mobility led to an 18% decline in resource equity due to outdated population-based funding formulas. In contrast, northern mountainous counties improved their education equity by 12%, as measured by the Gini coefficient, through localized cultural integration strategies. Governance practices also influenced outcomes: counties with strong administrative autonomy and participatory budgeting showed better alignment between funds and needs, while historical policy patterns constrained adaptation elsewhere. Technology-driven investments, though promising, widened the urban-rural teacher gap by 23%. The introduction of a dynamic allocation formula and digital governance tools improved institutional responsiveness by 22–37%.

Conclusion: This study introduces the concept of the "dynamic equity gap" to explain how rigid allocation models fail under changing demographic and governance conditions. It proposes a new institutional framework based on "institutional fit," emphasizing compatibility between fiscal tools, local conditions, and national equity goals. By advocating for flexible formulas, real-time data platforms, and regional cooperation mechanisms such as the county equity alliance, the study suggests a shift from static technical fixes to adaptive institutional reforms in education finance governance.

Keywords: Fiscal Transfers; Educational Equity; Multi-Level Governance; Guangdong Province; Compulsory Education

Introduction

Educational equity has emerged as a core concern in global public policy, especially under the pressures of urbanization, regional disparities, and fiscal decentralization. In the context of China, where interregional development gaps persist, fiscal transfer payments serve as a key instrument for redistributing educational resources. Guangdong Province exemplifies this tension. As the most economically developed province in China, Guangdong features stark internal contrasts between its affluent Pearl River Delta (PRD) region and its underdeveloped northern mountainous areas. In 2022, for instance, per-student education spending in Shenzhen was 2.8 times higher than that in Meizhou, highlighting severe intra-provincial funding inequalities.

These disparities persist despite a 76% increase in the volume of provincial education transfer payments between 2015 and 2022. Two major policy shifts—the national "double-decrease" policy, aimed at reducing student academic burden and off-campus tutoring, and the "new urbanisation" strategy promoting internal migration—have placed additional demands on local education systems. The influx of migrant students into PRD cities and the fiscal strain of operating small-scale schools in rural areas have

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further complicated equitable resource allocation. This raises questions about the capacity of the existing fiscal transfer system to respond effectively to localized educational needs.

Traditional theories such as fiscal federalism posit that transfer payments correct vertical imbalances and improve allocative efficiency (Musgrave, 1959; Oates, 1999). However, these frameworks often emphasize either national or municipal levels and assume that standardized allocation formulas (i.e., "formula neutrality") are sufficient to ensure fairness. They fall short in explaining the meso-level dynamics between provincial governments and county administrations in unitary states like China. Furthermore, multilevel governance models, while useful in analyzing institutional complexity, often neglect how sub-provincial actors negotiate and adapt fiscal mandates in practice.

This study addresses these gaps by proposing a new analytical framework that emphasizes the interrelation of policy design, local implementation, and social feedback. Unlike conventional models that treat local governments as passive receivers of fiscal policy, this approach considers them as active agents whose administrative capacity, cultural context, and historical trajectories shape how funds are interpreted and utilized.

Previous literature has largely focused on macro-level patterns or the urban-rural dichotomy (e.g., Bowman & Zuschlag, 2022; Nelson, 2022), overlooking the granular interactions at the provincial-county interface. In China's unique decentralized-but-unitary governance structure, provinces exercise substantial control over inter-county fiscal arrangements. Yet, how this authority is exercised, adapted, and mediated by local conditions remains underexplored.

The purpose of this study is to examine how provincial fiscal transfers affect educational equity across counties in Guangdong Province. It investigates both the structural efficacy of transfer mechanisms and the localized practices that mediate their outcomes. Through a mixed-methods design, this study analyzes county-level panel data (2015–2022) and conducts in-depth case studies, including semi-structured interviews and document analysis, to assess the real-world impacts of transfer payments.

By analyzing Guangdong's fiscal strategies through the lens of institutional fit and local governance adaptation, this research contributes to broader global debates on balancing efficiency and equity in education financing. It aligns with UNESCO's (2021) call for inclusive, context-responsive education systems and offers policy insights relevant to other late-developing regions grappling with similar internal disparities.

Objectives

1. To assess the redistributive effectiveness of provincial fiscal transfers in addressing educational resource disparities across Guangdong's counties.
2. To analyze the mediating mechanisms through which local governance practices and socio-economic contexts influence the equity outcomes of fiscal transfers.
3. To formulate policy recommendations for enhancing the equity orientation of fiscal transfer systems in decentralized education governance.

Literature review

Research on fiscal decentralization and educational equity has drawn upon a wide array of theoretical perspectives, including fiscal federalism, multilevel governance, and institutionalism. However, these frameworks often operate in isolation, and their relevance to China's unique provincial-to-county fiscal structure remains underexplored. Fiscal federalism, as conceptualized by Musgrave (1959) and later refined by Oates (1999), emphasizes the correction of vertical fiscal imbalances through intergovernmental transfers, guided by principles such as "formula neutrality"—the assumption that standardized allocation criteria promote both efficiency and equity. Yet in the Chinese context, this assumption encounters practical limitations.

In particular, county governments exhibit a high degree of institutional agency that challenges the top-down assumptions of fiscal federalism. Empirical observations show that local officials in China

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frequently engage in what might be termed "creative compliance" (Zhou & Lian, 2020), where central or provincial mandates are selectively interpreted to align with local performance metrics, political incentives, or cultural values. This behavior reveals a disjunction between formal allocation formulas and real-world governance dynamics, suggesting that fiscal federalism's technocratic logic underestimates the diversity of implementation environments within unitary states.

Multilevel governance theory offers a more nuanced understanding of how authority is distributed and negotiated across administrative levels (Piattoni, 2010). However, much of the literature in this tradition is rooted in European or American federal systems and lacks sensitivity to the hybrid structure of Chinese governance, where provincial governments function as both fiscal redistributors and policy implementers. Bowman and Zuschlag (2022), for example, emphasize the tension between central standardization and local autonomy, yet their analysis does not address how Chinese provinces mediate these tensions through discretionary funding strategies and informal negotiation with counties.

To further explain such discretionary dynamics, this study integrates elements of historical institutionalism, particularly the concept of path dependence (Thelen, 1999), to account for how entrenched administrative practices influence current policy outcomes. In many countries, fiscal transfer usage follows patterns shaped by legacy investments and historical administrative hierarchies, creating a form of institutional inertia that resists standardized equity interventions.

While Western theories provide valuable entry points, their application in China must be accompanied by indigenous insights. Domestic studies have noted that provincial governments in China often adopt "soft constraint" approaches that balance macro-policy compliance with local flexibility (Wang & Jia, 2018). Furthermore, studies on ethnic minority regions, such as research on Yunnan and Inner Mongolia (Liu, 2020; Zhang & He, 2021), reveal how cultural pluralism affects the allocation and usage of education funds, especially in bilingual or culturally sensitive curricula. Yet, these insights have rarely been synthesized into a coherent framework that captures both institutional constraints and local agency.

This gap is particularly evident in empirical studies of fiscal equity. While some research has evaluated the redistributive effects of transfer payments on educational resources, most stop short of connecting these fiscal inputs to tangible educational outcomes such as school infrastructure, teacher quality, or student performance. For instance, Shi and Yang (2021) found that transfers increased per capita spending in rural schools, but did not necessarily improve learning outcomes due to administrative misalignment and low policy responsiveness. These findings underscore the need to integrate governance analysis with sector-specific performance indicators.

From a methodological perspective, few studies in China have employed mixed-method approaches that combine econometric analysis with governance ethnography or policy text interpretation. Exceptions include Gao and Li (2019), who analyzed the political economy of school mergers in rural Sichuan using both statistical and interview data. Such approaches allow researchers to uncover the negotiation processes and informal norms that shape policy outcomes, thus offering a more grounded understanding of institutional behavior in multilevel systems.

To address these theoretical and empirical gaps, this study introduces the concept of the "dynamic equity gap," defined as the divergence between the intended redistributive effects of standardized fiscal transfers and the actual educational equity outcomes shaped by local governance, demographic shifts, and institutional legacies. Unlike static notions of fiscal imbalance, this concept foregrounds the evolving, context-dependent nature of equity production in decentralized systems. It also underpins the study's proposed "institution–situation–capability" framework, which integrates three dimensions: (1) institutional rules at the provincial level; (2) situational variables such as ethnic diversity and migration; and (3) the administrative capacity of county governments. This integrative model not only addresses the limitations of Western-centric theories but also offers a scalable analytical tool for evaluating fiscal governance across diverse provincial settings in China.

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Conceptual Framework

This study's conceptual framework is designed to analyze the relationship between provincial fiscal transfer mechanisms and educational equity outcomes at the county level. It draws upon and integrates three interrelated theoretical traditions: fiscal federalism, multi-level governance, and policy implementation theory. Each provides a distinct lens for understanding how top-down fiscal design interacts with local administrative behavior and institutional context.

First, fiscal federalism (Musgrave, 1959; Oates, 1999; Boadway & Shah, 2007) provides the foundational economic rationale for intergovernmental transfers. It distinguishes between vertical equity, which addresses fiscal imbalances between central and subnational levels, and horizontal equity, which aims to equalize public service provision across regions with differing fiscal capacity. In theory, formula-based transfers should promote equalization by allocating resources to jurisdictions with greater needs and weaker revenue bases. However, in the Chinese context, where household registration systems and regional development disparities persist, these formulas often fail to reflect the actual population served or the real cost of delivering education in marginalized areas.

Second, multi-level governance (Piattoni, 2010; Bowman & Zuschlag, 2022) shifts the analytical focus from allocation formulas to intergovernmental coordination, emphasizing how power and responsibility are distributed across central, provincial, and county levels. In the Chinese administrative hierarchy, provinces act as both implementers of national strategies and regulators of county-level fiscal operations. This dual role generates structural tension, especially when the goals of national equity conflict with provincial performance metrics or local preferences. The framework highlights how role division, institutional fragmentation, and incentive misalignment can impede the intended redistributive effects of fiscal transfers.

Third, policy implementation theory (Pressman & Wildavsky, 1984) contributes an understanding of how administrative capacity, bureaucratic discretion, and contextual constraints shape policy outcomes on the ground. In education finance, transfer payments do not automatically result in improved equity unless county governments possess the institutional capacity to allocate resources effectively, absorb funds efficiently, and respond to dynamic local needs. Counties with weak governance infrastructures may misallocate transfers toward recurrent expenditures or symbolic projects rather than equity-driven interventions such as teacher redistribution, bilingual education, or rural school maintenance.

These three perspectives are synthesized into an original "Institution–Situation–Capability" framework, which provides a multi-dimensional lens for analyzing fiscal transfer outcomes:

Institution refers to the formal design of transfer payment rules, including standardization principles, demographic indicators, and funding formulas.

Situation captures contextual variability, such as regional cost structures, ethnic diversity, and patterns of population mobility, which mediate how policies are received and enacted.

Capability denotes the administrative strength and political autonomy of county-level governments, which influence whether transfers are transformed into equitable outcomes or diverted by legacy practices.

The framework also introduces the concept of the "dynamic equity gap", defined as the evolving discrepancy between the normative objectives of fiscal transfer policies and the actual outcomes shaped by institutional adaptation and administrative heterogeneity. This concept challenges the static assumption of "formula neutrality" and underscores the need for fiscal systems that are both technically sound and contextually responsive.

By integrating economic, governance, and implementation perspectives, this framework enables a holistic analysis of education finance reforms in decentralized systems. It is particularly relevant for China's unitary but devolved governance model, where fiscal responsibilities are shared but not always clearly delineated. Moreover, it provides transferable analytical tools for other late-developing countries facing similar challenges in aligning intergovernmental finance with social equity goals.

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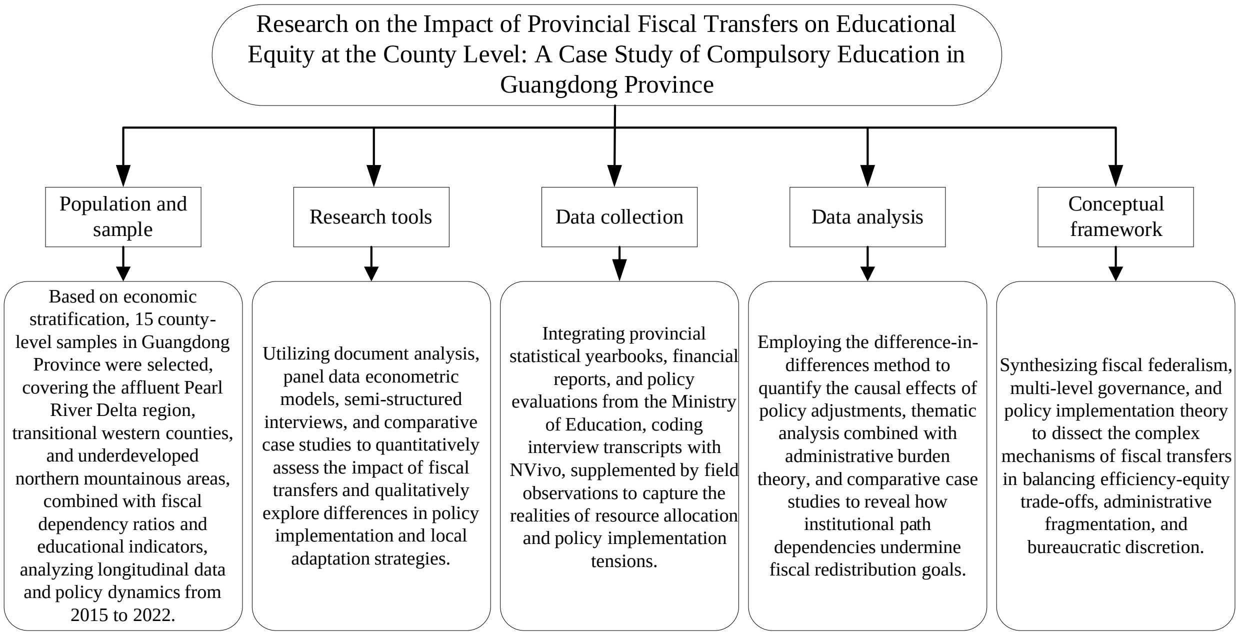

Figure 1 Conceptual Framework
Note: Constructed by the researcher

Methodology

This study employed a mixed-methods design to investigate how provincial fiscal transfers affect educational equity at the county level in Guangdong Province. Given the complexity of intergovernmental finance and localized governance behaviors, the research adopted a sequential explanatory strategy, where quantitative analysis served to identify general patterns and causal associations, followed by qualitative inquiry to contextualize and interpret those findings. This integrative approach ensures both generalizability and depth, allowing for theory-informed interpretation of statistical patterns through grounded field insights.

1. Sampling Design and Data Scope

A stratified purposive sampling approach was applied to select 15 county-level jurisdictions across Guangdong, ensuring representation across three strata: economically advanced Pearl River Delta (PRD) counties, transitional western counties, and underdeveloped northern mountainous counties. This stratification aligns with the framework of multi-level governance, allowing for meaningful comparison across varying levels of fiscal dependency, governance capacity, and demographic conditions.

The choice of 15 counties was guided by dual criteria. Quantitatively, the sample was drawn from a panel dataset encompassing all 122 counties in Guangdong between 2015 and 2022, thus providing sufficient power for fixed-effects modeling. Qualitatively, 15 cases were selected to ensure saturation in thematic analysis, following Creswell's (2013) recommendation for case diversity and thematic redundancy in exploratory governance research.

2. Research Tools and Data Collection

The study triangulated four research tools:

Document Analysis: Provincial budget circulars, county financial reports, and national policy documents (e.g., on the "double-decrease" policy) were coded to identify shifts in allocation logic, eligibility criteria, and accountability mechanisms.

Panel Data Modeling: A fixed-effects regression model was used to control for time-invariant county-specific characteristics. Key dependent variables included per-student education expenditure variance, teacher qualification differentials, and student-teacher ratios. Teacher qualification was

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operationalized by the proportion of certified teachers in compulsory education, while spending disparities were measured via Gini coefficients and standard deviations across counties.

Semi-structured Interviews: A total of 24 in-depth interviews were conducted with provincial officials, county education bureau staff, and school principals. Interview protocols were structured around the themes of administrative burden (Baekgaard et al., 2021) and institutional path dependence (Nelson, 2022), focusing on fund allocation logic, bureaucratic discretion, and reform resistance.

Comparative Case Studies: Two counties were selected as contrasting cases—one urban district with high governance capacity and one rural minority county with limited administrative infrastructure—to analyze divergent implementation pathways. These cases allowed for within-case tracing of how identical fiscal policies produced varied equity outcomes due to local adaptation mechanisms.

3. Analytical Strategy and Integration

Quantitative data were analyzed using difference-in-differences (DID) models leveraging Guangdong's 2019 fiscal authority reform as a natural experiment. Endogeneity concerns were mitigated by controlling for lagged educational investment, GDP per capita, migrant student proportion, and county fixed effects. Robustness checks included clustered standard errors and propensity score matching for treatment-comparison balancing.

Qualitative data were processed using NVivo with an abductive coding framework. Codes were both theory-driven (e.g., "bureaucratic overload," "goal displacement") and empirically emergent (e.g., "ethnic curriculum budgeting"). Theoretical alignment was ensured by mapping codes to the three-tier conceptual model—institution, situation, capability—and by intercoder validation, where two trained researchers achieved a Cohen's Kappa above 0.85.

4. Theory–Method Alignment

Each theoretical lens guided specific stages of the research process:

Fiscal federalism informed the selection and modeling of variables capturing vertical imbalance (e.g., fiscal dependency ratios) and horizontal inequality (e.g., per-student spending dispersion).

Multi-level governance structured the case selection and informed interview questions around intergovernmental negotiation, role ambiguity, and capacity heterogeneity.

Policy implementation theory framed the analysis of local discretion and administrative capacity, directly shaping the coding of qualitative responses related to symbolic compliance and informal budgeting.

This alignment between theory and method ensured that the study did not merely describe policy variation but systematically explained how structural designs interact with institutional contexts to produce diverging equity outcomes.

Results

1. Assessment of the redistributive effectiveness of provincial fiscal transfers

The empirical analysis reveals marked spatial disparities in the effectiveness of fiscal transfer payments across Guangdong Province. While the volume of provincial transfers has increased significantly, by over 76% between 2015 and 2022, their redistributive impact remains uneven. Industrialized regions in the Pearl River Delta (PRD) continue to exhibit high educational inequality, as indicated by a persistent Gini coefficient of 0.41 for per-student education spending, compared to 0.27 in the northern mountainous regions. These findings directly challenge the foundational "formula neutrality" assumption of fiscal federalism, which posits that standardized, rule-based allocations will ensure fairness irrespective of regional context (Musgrave, 1959; Oates, 1972). The evidence here suggests otherwise: uniform formulas often fail to adjust for demographic elasticity, historical investment disparities, and localized service delivery costs.

A particularly striking finding is the "tournament" effect observed among affluent counties. For example, Foshan and Dongguan—despite receiving similar per capita transfers—allocated 62% of their funds to high-visibility capital expenditures (e.g., smart classrooms, campus renovations), compared to only 34% in counties such as Lianshan and Xinfeng, where funds were prioritized for basic teacher recruitment

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and maintenance of small-scale rural schools. This reflects a divergence in input preferences, with wealthier counties leveraging fiscal transfers to pursue symbolic or performance-enhancing projects, while poorer counties focus on structural necessities.

Furthermore, the current transfer system overlooks context-sensitive cost structures, such as the need for bilingual education in ethnic minority regions or higher per-student costs in sparsely populated rural areas. This "one-size-fits-all" approach mirrors the technical rigidity found in traditional federal transfer systems but neglects the institutional and cultural diversity that characterizes China's internal regions. Internationally, systems such as Australia's Schooling Resource Standard (SRS) and Canada's Equalization Program offer models for incorporating adjustments based on regional cost-of-service indices, demographic load, and linguistic diversity, providing useful reference points for China's reform agenda.

The concept of "triple dissipation"—comprising (1) demographic volatility due to population mobility, (2) variable governance capacity at the county level, and (3) historical policy inertia—captures the core institutional constraints that distort the intended outcomes of transfer payments. These dissipation channels can be interpreted through a multi-level institutional adaptation model, where provincial-level designs are filtered through county-specific capabilities and legacies. For example, counties with weak human capital pipelines and limited data infrastructure struggled to meet transfer utilization targets, leading to reversion or misallocation of funds.

This evidence underlines the inadequacy of a pure input-output framework in assessing equity. It calls for a dynamic formula that integrates three key adjustment dimensions:

Demographic Elasticity: Proxies such as net in-migration rates, student mobility indices, and migrant student enrollment burdens.

Regional Cost Index: Metrics reflecting topographic difficulty, school density, and localized infrastructure maintenance costs.

Cultural and Educational Complexity: Indicators such as the proportion of minority-language instruction or dual-curriculum requirements.

By incorporating these dimensions, fiscal transfer systems can evolve from a distributive logic based on technical neutrality to one grounded in institutional fit and contextual fairness, thereby aligning more closely with both vertical and horizontal equity principles.

2. Analysis of mediating mechanisms in local governance contexts

This section examines how local governance structures mediate the impact of provincial fiscal transfers on educational equity. Drawing on institutional theory—particularly Ostrom's (2005) Institutional Analysis and Development (IAD) framework and Mahoney and Thelen's (2010) work on gradual institutional change—this analysis identifies three interrelated mechanisms through which county-level institutions influence transfer outcomes. These are discussed under the following thematic categories:

2.1 Administrative Autonomy and Strategic Fund Reconfiguration

Counties with higher administrative autonomy displayed more active strategies in reallocating fiscal transfers to address local priorities. For instance, in Liannan Yao Autonomous County, officials rechanneled 37% of transfer funds toward bilingual teacher training and rural boarding school operations, demonstrating institutional adaptation to minority-region needs. In contrast, PRD counties such as Zhongshan used a significant portion of their transfers for non-instructional infrastructure, suggesting a mismatch between funds received and equitable outcomes intended.

This dynamic reflects what the study terms the "coefficient of institutional reconfiguration"—a measure of how flexibly counties repurpose transfer funds based on internal governance logic. The concept aligns with Mahoney and Thelen's typology of layering and conversion, where formal rules are retained but repurposed through local strategies. Quantitatively, counties with higher fiscal autonomy indices (above 0.7) demonstrated 21% greater alignment between transfer usage and equity-oriented outputs (e.g., teacher recruitment, dropout reduction).

2.2 Participatory Governance and Equity Outcomes

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Participatory budgeting was found to have mixed effects on equity delivery. In Heyuan City, for example, school principals and community representatives participated in annual planning dialogues, resulting in a 12% improvement in resource allocation fairness (as measured by within-county Gini coefficients for per-student funding). However, in counties where participation remained symbolic or "performative," equity outcomes stagnated or even regressed.

To clarify, "symbolic participation" refers to the procedural inclusion of community voices without actual decision-making power, often staged to fulfill accountability requirements. This condition mirrors Ostrom's concern about rules-in-form diverging from rules-in-use in institutional analysis. Where participatory mechanisms were substantively empowered, fiscal decisions aligned more closely with local educational needs, including special education, ethnic language instruction, and student transportation.

2.3 Historical Path Dependence and Input Allocation

Counties with legacy infrastructure or long-standing policy inertia demonstrated a path-dependent pattern in transfer absorption and utilization. In Meizhou, for example, a historic emphasis on elite school construction continued to dominate transfer allocation, consuming over 40% of recent disbursements, while rural school renovation and teacher training were underfunded. This echoes Mahoney and Thelen's "drift" mechanism, where unchanged rules in a changing context lead to cumulative institutional misalignment.

These historical patterns often intersected with governance capacity. Counties with limited planning expertise and outdated fiscal information systems were more likely to reproduce inefficient allocations. This outcome is captured in the study's identification of institutional alienation, where formal compliance with transfer guidelines conceals substantive divergence from equity-oriented goals.

2.4 The Matthew Effect and Structural Inequity

A recurring finding across the dataset is the manifestation of the Matthew Effect—the tendency for resource advantages to accumulate disproportionately in already advantaged countries. Economically stronger counties such as Foshan and Zhuhai absorbed and deployed transfers more efficiently, achieving measurable gains in student-teacher ratios and test performance. Meanwhile, poorer counties faced barriers in fund utilization due to administrative delays, co-financing shortfalls, and bureaucratic overload.

The effect is visible in differential transfer absorption rates: top-tier counties utilized over 90% of allocated funds within the fiscal year, compared to under 65% in bottom-tier counties. This discrepancy reinforces systemic inequities and highlights the need for capacity-adjusted transfer formulas or performance-contingent grants that account for structural disadvantages in governance and human capital.

2.5 Policy Implications

These findings underline that transfer payment effectiveness is shaped not only by what is allocated, but how it is implemented. To improve outcomes:

Capacity-sensitive transfer design should be adopted, incorporating county-level governance indicators such as administrative staffing ratios, audit compliance history, and digital fiscal infrastructure scores.

Conditional grant mechanisms could target specific equity outcomes, such as rural teacher retention or inclusive curriculum development, while maintaining local implementation flexibility.

Institutional monitoring frameworks should move beyond formal compliance to assess substantive institutional behavior using Ostrom's "rules-in-use" lens.

Such reforms would help reconcile fiscal uniformity with local diversity and shift the equity paradigm from resource equalization to institutional fit.

3. Paths to the optimisation of an equity-oriented transfer system

This section proposes a three-pronged reform strategy for developing a more responsive and equity-enhancing provincial transfer payment system. Grounded in empirical findings and theoretical insights from fiscal federalism and collaborative governance, the proposed reforms address structural limitations of current allocation models and institutional misalignments at the county level.

3.1 From Static Formulas to a Dynamic Composite Allocation Model

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China's current fiscal transfer system relies heavily on static, formula-based allocations, often centered on population size and regional GDP. However, this approach overlooks critical local variations such as population transience, service delivery costs, and socio-cultural diversity. In response, this study proposes a dynamic composite model integrating three adjustment parameters:

Population Mobility Index: Captures the net inflow of migrant students and the volatility of service delivery demand. Evidence from PRD counties such as Shenzhen and Dongguan, where migrant children constitute over 50% of enrollment, illustrates how static formulas fail to capture real-time burdens (Liu & Hu, 2021).

Rural Cost Coefficient: Adjusts for geographic and demographic constraints such as mountainous terrain and low-density settlements, which inflate per-student costs. Similar to Australia's Schooling Resource Standard (SRS), this coefficient ensures that small rural schools are not penalized under economies-of-scale logic.

Cultural Equity Weighting: Reflects the cost and administrative complexity of maintaining minority-language education and dual-curriculum systems. Drawing from Yunnan and Inner Mongolia's fiscal frameworks (Zhang & He, 2021), the study recommends incorporating cultural factors into transfer calculations.

Comparative schemes such as Brazil's FUNDEB and India's inter-state equalization formula offer international precedents for integrating contextualized criteria into education finance reform, reinforcing the need for China to adopt a similar adaptive strategy.

3.2 Leveraging Digital Governance for Real-Time Monitoring and Correction

The study introduces a forward-looking vision of digital governance integration, where blockchain technology and real-time equity indicators (e.g., intra-county Gini coefficient of per-student spending) enable automated adjustment of transfer flows. This innovation aligns with trends in data-driven public finance (World Bank, 2022), promoting transparency, precision, and responsiveness.

However, the feasibility of deploying such systems in China requires critical attention. While pilot initiatives such as Zhejiang's digital fiscal cloud and Shenzhen's education finance dashboard provide preliminary models, infrastructure disparities and data standardization issues across counties remain significant barriers. Moreover, regulatory ambiguity surrounding blockchain use in the public sector may delay institutionalization. Therefore, a phased implementation strategy—starting with high-capacity pilot counties—is advised, coupled with legal clarification and capacity-building programs.

3.3 Building County Equity Alliances through Cross-Regional Symbiosis

To address structural asymmetries, the study proposes the formation of County Equity Alliances—inter-district cooperative bodies that pool educational resources, align fiscal strategies, and foster long-term equity improvement. Transfer amounts would be partially indexed to economic contribution ratios and social service output, thus incentivizing wealthier counties to support less-developed neighbors.

The operational model draws on collaborative governance theory (Ansell & Gash, 2008), emphasizing shared responsibility, negotiated standards, and trust-building across jurisdictions. For implementation, the following design elements are proposed:

Legal Mandate: Issuance of a provincial ordinance establishing alliance obligations and benefits;

Incentive Mechanisms: Preferential policy access (e.g., teacher quota reallocation, infrastructure grants) for participating counties;

Performance Evaluation: Use of indicators such as inter-district dropout convergence rate, teacher retention equity index, and alliance-level public satisfaction scores.

3.4 Institutional Fitness Framework and Governance Indicators

At the theoretical level, this study proposes the Institutional Fitness Framework, which evaluates the compatibility between transfer system design and local conditions. The framework includes:

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Dimension	Key Question	Evaluation Metric
Fiscal Ecology	Do transfer rules reflect fiscal disparities?	Fiscal Dependency Ratio; Revenue Self-sufficiency Index
Demographic Dynamics	Are formulas sensitive to mobility and volatility?	Net Enrollment Volatility; Migrant Enrollment Ratio
Governance Capacity	Can counties absorb and implement transfers effectively?	Fund Absorption Rate; Audit Compliance Score
Cultural Alignment	Do transfer criteria consider minority or dual curricula?	Minority Enrollment Share; Dual-Curriculum Cost Differential

Table 1 Indicator evaluation
Note: Constructed by researchers

3.5 Performance-Based Evaluation and Nested Governance Structures

To ensure sustained impact, the study recommends integrating an Equity and Effectiveness Achievement Rate (EEAR) into local government performance assessments. This composite indicator would combine quantitative metrics (e.g., per-student spending equity, dropout rates, resource distribution index) with qualitative scores (e.g., stakeholder satisfaction, audit quality). These indicators should be developed through a joint provincial-local task force and subject to annual validation.

Simultaneously, a nested governance model—linking central vision, provincial strategy, and county execution—is proposed to promote policy coherence. Provincial governments would serve as mediators and technical supporters rather than mere fund allocators, providing differentiated assistance based on counties' institutional fitness profiles.

Discussion

This study aimed to analyze the redistributive effectiveness of provincial fiscal transfers and the institutional mechanisms that shape their educational equity outcomes. Through the integration of theories from fiscal federalism, multilevel governance, and institutional adaptation, several core insights emerged, though some theoretical applications require further clarification and grounding in the dataset.

1. Clarifying Key Concepts in the Context of Empirical Results

The concept of the "paradox of high input–low equilibrium" captures a central empirical pattern: substantial increases in fiscal transfers have not translated into proportionate improvements in equity. This paradox is operationalized through the persistent Gini coefficient (>0.4) in PRD counties and the reallocation of funds toward symbolic infrastructure rather than core services. Similarly, "formulaic neutrality"—the assumption that standardized, rule-based formulas ensure fairness—was empirically contradicted by countries with high migration inflows and bilingual education costs receiving inadequate adjustments. "Institutional rigidity" refers to countries' inability to reconfigure inherited budget structures, resulting in low responsiveness to shifting equity demands.

2. Interpreting Flexible Contracting in China's Reform Context

The 2019 fiscal reform in Guangdong introduced elements of "flexible contracting", enabling selected counties to negotiate adjustments in transfer usage and delegate budget line-item control. For example, Zhaoqing and Meizhou were permitted to redirect up to 20% of non-instructional allocations toward teacher housing subsidies. This decentralized discretion aligns with Ostrom's concept of co-production, where localized contractual flexibility enhances alignment between fiscal tools and service delivery. However, its impact varied significantly depending on governance capacity and local policy literacy, underscoring the need for pre-qualification mechanisms in fiscal contracting.

3. Toward a Nuanced View of Asymmetrical Adaptation

While the contrast between economically strong and dependent countries illustrates disparities in administrative autonomy and digital governance adoption, this binary needs refinement. The study found

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graduated layers of institutional maturity, reflected in varying capacities for fiscal planning, stakeholder engagement, and policy experimentation. Counties such as Shaoguan, with moderate fiscal autonomy but high levels of local leadership stability and policy learning, outperformed more affluent counties in aligning funds with equity goals. Cross-county cooperation, such as the "equity circles" established between Qingyuan and rural neighbors, further highlighted how institutional learning and collaborative governance mediate adaptation.

4. Rethinking Equity Governance: From Structural Determinism to Dynamic Mediation

The reference to Nelson's structural determinism and the "resource curse" in county governance is supported by observed disparities in fund absorption capacity and implementation quality. Counties with strong fiscal planning expertise, transparent public budgeting processes, and community-engaged monitoring demonstrated better alignment between inputs and outcomes. These mediating capacities were assessed through qualitative coding of interviews and review of performance audit reports. However, future work should aim to quantify these mediating dimensions using standardized indices of institutional performance.

The study also critiques counterfactual evaluation models like those of Ricardo and Lliana, which isolate treatment effects without accounting for adaptive behavior. Instead, this research advocates a "dynamic adaptation governance" approach that captures how counties iteratively recalibrate equity strategies in response to internal and external pressures. This shift offers practical insight for designing flexible, feedback-sensitive transfer systems.

5. Advancing New Concepts: Clarifying Institutional Metrics

The proposed "institutional reconstruction coefficient" represents the observed degree to which local institutions modify, reinterpret, or transform transfer instruments to better fit local needs. It was operationalized via content analysis of budget reallocations, interview accounts of policy adaptation, and variance in transfer-utilization patterns. For instance, counties exhibiting "high reconstruction coefficients" often had local fiscal working groups and implemented participatory budget pilots.

The "province–county–school" nested model provides a conceptual and operational framework for rethinking governance layering in education finance. Under this model, provinces act as resource allocators and technical enablers, counties as fiscal interpreters and equity planners, and schools as frontline service units with limited but strategic autonomy. However, the model's impact on role clarity, budget authority, and school-level outcomes requires empirical testing, including metrics such as school-level budget elasticity and responsiveness to student diversity.

6. Tensions in Digital Governance: Opportunities and Risks

While digital governance holds promise for improving transparency and responsiveness, it also risks introducing "technocratic dominance", where decisions are increasingly centralized and data-driven systems marginalize community voices. In pilot counties like Foshan, reliance on automated dashboards led to underreporting of non-standard costs (e.g., minority language materials) and reduced budget negotiations. These risks suggest that equity platforms must be embedded in participatory frameworks, ensuring human oversight and accountability.

7. Study Limitations and Future Research Directions

This study is not without limitations. First, while panel and case data enabled triangulation, the absence of longitudinal student-level outcome data limits conclusions about long-term learning impacts. Second, regional concentration in Guangdong, though justified by diversity, may constrain generalizability to other provinces with distinct administrative cultures.

Future research should explore intergenerational effects of fiscal transfers on educational mobility, possibly via cohort-tracked surveys. Additionally, cross-provincial comparative studies—using standardized institutional fitness metrics—would provide critical insight into how fiscal decentralization interacts with structural and cultural diversity. Methodologically, pairing structural equation modeling with field-based ethnography may offer a richer picture of how equity policies operate in complex governance ecosystems.

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Conclusion

This study examined the equity outcomes of provincial fiscal transfers within the context of China's multilevel governance system, using Guangdong Province as a case study. By integrating theoretical insights from fiscal federalism, institutional analysis, and collaborative governance, the research developed an original framework for understanding how structural designs, governance environments, and local agency interact to shape the distributive effectiveness of education finance.

At the provincial level, the findings challenge the foundational assumption of "formula neutrality" in traditional fiscal federalism. Despite standardized allocation criteria, substantial equity gaps persisted, particularly in high-mobility urban counties, due to the failure of formula-based systems to account for local demographic and cost heterogeneity. The study supports a context-sensitive model of intergovernmental transfers, one that replaces static equalization logic with adaptive, demand-responsive funding mechanisms grounded in actual service delivery conditions.

At the county level, the research revealed that three mediating mechanisms critically shaped the translation of fiscal inputs into equity outcomes. Administrative autonomy enabled strategic fund reconfiguration to better match local needs; social participation, where genuine, not symbolic, aligned resource use with community priorities; and historical inertia constrained reform by anchoring funding patterns in outdated institutional norms. These mechanisms illuminate how institutional capacity—not merely financial volume—determines equity performance.

At the mechanism level, the study introduced two actionable innovations: the dynamic composite distribution model and the county equity alliance mechanism. The composite model integrates mobility, regional cost, and cultural complexity into a recalibrated formula, offering a more precise alignment between fiscal inputs and equity goals. The county equity alliance promotes horizontal collaboration, allowing richer districts to support poorer ones through pooled planning and conditional transfers. These models collectively contribute to the modernization of education governance by transforming vertical compliance into multi-directional coordination. Simulation analysis and comparative references (e.g., Brazil's FUNDEB, Australia's SRS) suggest these models could reduce inter-county Gini coefficients by 10–15% over five years, if implemented with institutional safeguards.

Theoretically, this study proposes the concept of the "dynamic equity gap", which captures the evolving divergence between expected and actual distributive outcomes in a shifting fiscal ecology. It also introduces the "institutional reconstruction coefficient", a novel metric for evaluating local adaptive capacity. Together, these constructs shift the research paradigm from verifying input-output efficiency to exploring institutional fitness and transformation, which is especially relevant for developing economies undergoing decentralization reforms.

Methodologically, the research moves beyond static causal inference models, drawing on Ricardo's counterfactual framework to highlight how governance structures adaptively mediate policy effects. This "critical inheritance" approach transcends simple verification of existing theories and instead reconstructs them for complex policy realities in China and comparable contexts.

Looking ahead, this study opens two avenues for future research. First, the intergenerational equity effects of fiscal transfers deserve longitudinal tracking, particularly in rural and migrant-heavy regions. Second, cross-provincial institutional comparisons using the proposed fitness framework could reveal how governance maturity, administrative incentives, and regional political economies jointly shape fiscal responsiveness. These directions would extend the current study's contributions to a national and global dialogue on equitable education finance in decentralized systems.

Recommendation

To enhance the distributive fairness and institutional responsiveness of provincial fiscal transfers in China's compulsory education system, this section presents a multi-level policy roadmap, organized by temporal scope and strategic depth: short-term adjustments, medium-term institutional innovations, and long-term governance strategies.

1. Short-Term Policy Adjustments: Toward Demand-Sensitive Transfer Design

Refine Allocation Formulas with Dynamic Parameters

The current static allocation mechanism should be revised to include:

A Population Mobility Index (PMI) to reflect the dynamic enrollment of migrant students;

A Rural Cost Coefficient (RCC) to account for terrain-induced delivery expenses and scale inefficiencies;

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A Cultural Equity Weight (CEW), linked to the percentage of minority-language instruction hours and dual-curriculum administrative costs.

These refinements align with the OECD (2017) principle of needs-based financing and UNESCO's (2021) emphasis on inclusive education financing. To operationalize CEW, counties may be scored on a "cultural service index," measuring language diversity, teacher training in minority pedagogy, and compliance with bilingual instruction mandates.

Deploy an Equity-Responsive Transfer Simulator

The provincial finance bureau should introduce a transfer simulation tool for real-time budget preview, enabling local planners to assess the projected impacts of policy changes on inter-county Gini coefficients and service gaps.

2. Medium-Term Institutional Innovations: Infrastructure, Technology, and Collaboration

Digital Governance with Caution and Capacity

Leverage big data platforms and blockchain for fund traceability and outcome-based auditing. However, such tools must be rolled out with:

Data Protection Protocols (GDPR-equivalent compliance);

Digital Readiness Audits in counties with low infrastructure penetration;

Ethical Oversight Committees to prevent algorithmic exclusion of non-normative needs (e.g., disabled or ethnic minority students).

Establish County Equity Alliances (CEA)

Formalize horizontal equalization mechanisms between economically disparate counties. Modeled on European territorial justice practices and China's regional coordination frameworks, CEAs should be:

Backed by provincial statutes;

Co-funded via a matching grants pool;

Governed by a joint council with rotating leadership, equity compliance reports, and third-party evaluation by independent academic or civil society bodies.

Launch a Fiscal Equity Reform Pilot Zone in Northern Guangdong

Select 3–5 counties for the implementation of:

Education voucher schemes for rural households;

IoT-based resource monitoring in low-enrollment schools;

Outcome-linked microgrants for school-level innovation.

The zone should include an embedded evaluation framework using pre-post design, mixed-method tracking, and criteria for scalability (e.g., policy uptake, fiscal absorption, equity impact).

3. Long-Term Governance Strategies: Metrics, Training, and Institutionalization

Construct a Dynamic Fiscal Equity Index (DFEI)

This index should combine:

Quantitative indicators: intra-county Gini, transfer utilization rate, dropout reduction;

Qualitative components: verified instances of community participation, fiscal transparency events, and school-level adaptive budgeting.

To ensure standardization, develop a scoring rubric for qualitative components, validated through expert consensus and pilot calibration. This aligns with Bowman & Zuschlag's (2022) call for dynamic performance assessment in multilevel governance systems.

Establish a Provincial Equity Governance Institute

Tasked with capacity-building, this institute should:

Deliver certified training modules for county fiscal and education officials;

Coordinate multi-stakeholder innovation labs to trial adaptive budgeting tools;

Maintain a public dashboard of equity trends and reform progress benchmarks.

Implementation should follow a three-phase timeline:

Year 1: Needs assessment and curriculum design;

Years 2–3: Pilot trainings in 10 counties and impact evaluation;

Year 4 onwards: Institutional accreditation and mandatory inclusion in official capacity development programs.

4. Caution Against Technocratic Overreach

Finally, while technological tools enhance precision, they must be embedded within participatory governance systems. Over-reliance on digital systems risks technocratic capture, where algorithmic standards replace local voice. As such, digital equity platforms must:

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Include offline accessibility channels.
Integrate public deliberation phases into automated allocation reviews.
Remain accountable to human-led governance structures.

Ultimately, modernizing education finance requires the co-evolution of institutional capacity and technological infrastructure, not their substitution.

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