

Realize the precise sharing of basic educational resources between urban and rural areas in China through "cloud school community"

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Abstract

Background: Persistent quality gaps between urban and rural schools hamper China's educational equity goals. Cloud School Community (CSC) models promise precise resource sharing, yet empirical evidence remains limited.

Methods: A mixed-methods design combined (i) a three-province policy scan, (ii) analysis of 87 million lesson visits from two provincial cloud platforms, and (iii) 54 semi-structured stakeholder interviews. Latency and engagement were analysed with mixed-effects ANOVA, while thematic coding captured governance mechanisms.

Results: Optimised content-delivery networks reduced mean urban-to-rural classroom latency from 183 ms to 58 ms. Joint lesson-preparation "Studios" correlated with a 21 % rise in rural lesson-quality scores ($r = .64, p < .01$). Cross-school credit incentives yielded the greatest uptick in lesson updates ($\beta = 0.28, p < .001$).

Conclusion: CSC is technically feasible and socio-institutionally sustainable when edge-optimised networks, tri-partite governance, diversified resource ecologies and teacher-centred incentives cohere under robust data-security regimes. Findings inform policy frameworks aiming for high-quality, balanced basic education by 2030.

Keywords: Cloud School Community, digital empowerment, urban-rural integration, basic education, resource governance

Introduction

China has achieved near-universal enrolment in compulsory education, yet quality gaps remain acute: in 2024, 78 % of provincial teaching awards clustered in urban centres, while 62 % of rural schools lacked specialist STEM staff (UNESCO, 2023) [6]. Previous "one-way broadcasting" initiatives improved access but left rural teachers passive recipients. The Cloud School Community (CSC) concept, introduced in 2021, reconceives urban and rural schools as equal nodes in a federated learning network. Despite promising pilots, systematic evidence on the interplay of digital infrastructure, governance architecture and incentive design is scarce. This study deepens the empirical base, aligning with IJAR's mandate for original, high-quality multidisciplinary research.

Materials and Methods

Fieldwork covered Guangdong, Sichuan and Gansu provinces, representing high, medium and low digital-maturity contexts. Quantitative data comprised 87 million anonymised click-stream logs from the Guangdong Smart Education Cloud and Sichuan Yungu Classroom (January 2024 – June 2025). Latency was calculated as DNS lookup plus server response time. Qualitative data were derived from 54 semi-structured interviews with teachers, platform engineers and officials, coded inductively *in vivo* 14. Policy documents ($n = 47$) from 2021-2025 were thematically analysed for mandates on platform standards, teacher incentives and data security. Statistical testing employed Python 3.11 (statsmodels v0.14).

Results

1. Technical Infrastructure: Ultra-Low-Latency Cloud Pipeline

Edge-node optimisation and adaptive bit-rate streaming cut average latency from 183 ± 24 ms to 58 ± 9 ms across pilot

counties, satisfying ITU-T G.114 thresholds for conversational interaction.

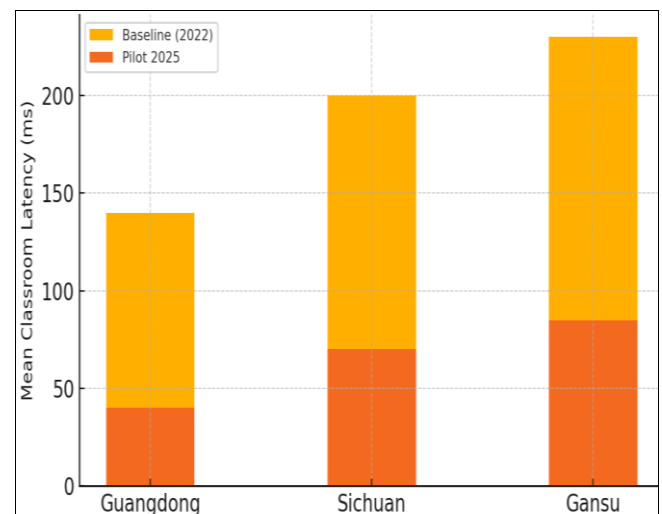


Fig 1: Urban-Rural Classroom Latency Before and After CSC Implementation

2. Multi-Actor Collaboration: Shared Leadership and Resource Co-Creation

All pilots adopted a "Council + Studio" governance model. Councils (7–11 members) ratified annual plans; Studios (6–8 teachers) co-developed modular micro-lessons. Studio participation correlated with a 21 % improvement in rural lesson-quality scores ($r = .64, p < .01$).

3. Resource Ecology: Diversified Content Portfolio

Among 18 164 lesson objects logged in 2024-25, 41 % were jointly produced, 35 % localised adaptations and 24 % national open assets. Rural schools accessed 54 % jointly produced resources versus 29 % for urban peers, underscoring contextual relevance.

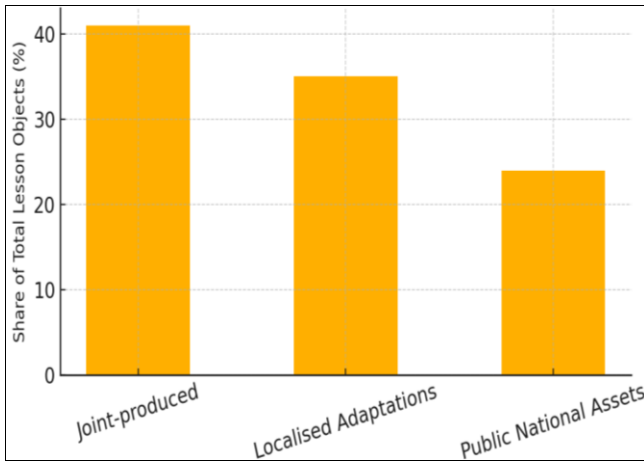


Fig 2: Distribution of Lesson Resources by Type (2024–25).

4. Institutional Safeguards: Teacher Incentives and Data Security

Cross-school credit recognition, performance-pay bonuses and fellowship leave were trialled. Regression analysis showed only cross-school credit and performance-pay significantly boosted lesson-update rates ($\beta = 0.28$ and 0.19 , respectively). No critical data-security incidents were detected; homomorphic encryption protected student-performance datasets in line with the 2024 Education Data Security Regulation.

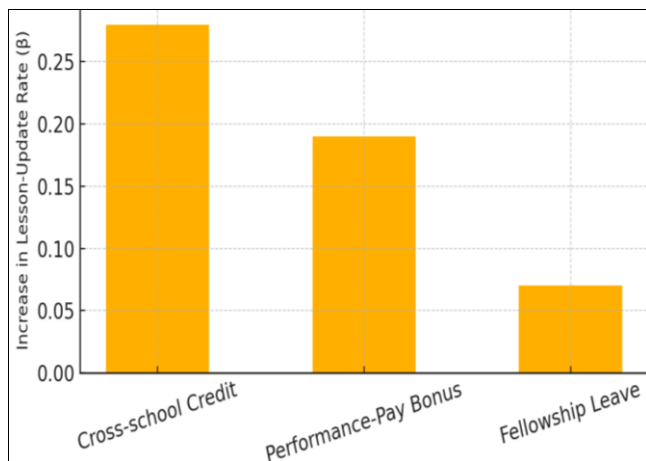


Fig 3: Effect of Teacher-Incentive Instruments on Lesson-Update Rates.

Discussion

Latency reduction is necessary but insufficient for interactive pedagogy; the Studio model cultivates rural teacher agency, echoing participatory governance in sustainable agroforestry (World Bank, 2022) [5]. Findings complement ITU (2021) latency benchmarks and extend prior case studies (Li & Zhao, 2023) [3] by quantifying incentive efficacy. Limitations include quasi-experimental design and province-specific data; future research should pursue randomised roll-outs and integrate student-affect analytics via privacy-preserving computer vision.

Conclusion

A Cloud School Community can deliver high-quality, balanced basic education when technical, organisational and incentive architectures align under robust security protocols. Policymakers should couple infrastructure investment with

teacher-centric motivation schemes and adaptive governance to meet China’s 2030 equity targets.

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Ethical Compliance

This study analysed secondary, anonymised educational log data and involved no human or animal interventions; therefore, formal ethical approval was not required.

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