

Algorithmic Inclusion or Professional Displacement? Reconstructing Teacher Agency in Rural Small-Scale Schools in the Age of Artificial Intelligence and Demographic Contraction

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Abstract

As China navigates the unprecedented intersection of a “demographic winter” (negative population growth) and a “digital spring” (the explosion of Generative AI), rural basic education faces a critical juncture. The demographic hollowing has rendered traditional “scale-based” educational models obsolete in rural areas, leaving small-scale schools as the primary morphology. Concurrently, the rapid deployment of Artificial Intelligence in Education (AIEd) promises to bridge the resource gap but poses a new existential threat: the potential “deskilling” of rural teachers and the reduction of their role to mere “system operators.” Drawing upon the theory of **Socio-Technical Systems** and the **Ecological Approach to Teacher Agency**, this paper argues that the survival of rural education depends not on replacing teachers with algorithms, but on a fundamental reconstruction of teacher agency. We propose a transition from the “knowledge transmitter” to the “**algorithmic orchestrator**,” “**contextual curator**,” and “**emotional anchor**.” This study posits that only through this “human-in-the-loop” transformation can rural schools leverage AI to achieve personalized learning while preserving the cultural and emotional integrity of rural education.

Keywords

Rural education; Artificial intelligence (AIEd); Teacher agency; Human-AI collaboration; Demographic contraction; Digital divide

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1. Introduction: The twin revolutions of the 2020s

The 2020s have ushered in two profound revolutions that are reshaping the landscape of Chinese basic education. The first is demographic. In 2022, China’s population entered a phase of negative growth, a trend that is

disproportionately emptying rural areas. As urbanization accelerates, rural schools are shrinking. The “mega-school” model is vanishing from the countryside, replaced by “small-scale schools” (fewer than 100 students) and “teaching points.” While policy has shifted from “consolidation” to “preservation,” these schools suffer

from a chronic “brain drain” of qualified teachers^[1].

The second revolution is technological. The maturation of Generative AI and Intelligent Tutoring Systems (ITS) has led to a flood of digital resources entering rural classrooms. The “National Smart Education Platform” and various “Dual-Teacher Classrooms” aim to use technology to level the playing field^[2].

However, the convergence of these two trends creates a paradox. While technology provides high-quality content (solving the “teaching” problem), it cannot solve the “educating” problem. There is a growing concern that as AI takes over instructional delivery, rural teachers—already marginalized—will face “technological displacement,” becoming passive supervisors of screens rather than active pedagogues. This paper argues that the introduction of AI into rural schools should not be viewed as a substitution strategy, but as a catalyst for redefining the unique value of the human teacher.

2. Literature review: From access to agency

2.1. The evolution of the digital divide in rural education

Early research on the digital divide focused on infrastructure (the “first-level divide”). With China’s massive investment in “Broadband China” and “ICT in Education 2.0,” this gap has largely closed. Recent scholarship identifies a “second-level divide” concerning the capability to use technology meaningfully, and a “third-level divide” concerning the tangible outcomes of usage^[3]. In rural contexts, this manifests as “shallow usage.” Teachers often use interactive whiteboards merely as expensive projection screens. Without a shift in pedagogical paradigms, hardware upgrades fail to translate into quality improvements^[4].

2.2. The risk of “algorithmic colonialism”

AI systems used in education are typically trained on data from urban, developed regions. When these systems are deployed in rural areas without adaptation, they impose urban-centric values, examples, and pacing. Scholars warn of “algorithmic colonialism,” where local rural knowledge and context are erased by standardized algorithmic curricula^[5]. If rural teachers lack the agency

to intervene, they become complicit in this cultural erasure.

2.3. Teacher agency in a socio-technical system

Agency is not merely an individual capacity but an ecological phenomenon achieved through the interplay of individual efforts, available resources, and contextual factors^[6]. In the age of AI, non-human actors (algorithms) become part of this ecology. The question is: Does the algorithm expand the teacher’s agency by handling rote tasks, or does it constrain agency by dictating rigid learning paths?

3. The crisis: The “redundant teacher” anxiety

In the demographic downturn, the economic logic for maintaining rural teachers weakens. If a village school has only 10 students, fiscal authorities may question the need for full-time staff, especially if “high-quality” lessons can be streamed from Beijing or Shanghai via AI platforms.

This utilitarian view creates an “instrumental fallacy.” It assumes that education is merely the transmission of standardized knowledge packets. If this were true, AI could indeed replace teachers. However, rural education serves a broader purpose: it is the anchor of community culture and the psychological safety net for “left-behind children” (children whose parents migrate for work).

The real crisis is not that AI is too smart, but that the rural teacher’s role is currently defined too narrowly. If teachers remain “knowledge repeaters,” they are indeed redundant. To survive, they must migrate up the value chain^[7].

4. Theoretical framework: Human-AI hybrid intelligence

We adopt the framework of human-AI hybrid intelligence, which suggests that the optimal educational outcome is achieved not by human or machine alone, but by a symbiotic partnership where each plays to their comparative advantage.

AI's advantage: Data processing, pattern recognition, infinite patience, and personalization of repetitive drills.

Humans' advantage: Empathy, context understanding, ethical judgment, complex improvisation, and emotional support.

In a rural small-scale school, the low student-teacher ratio provides the perfect physical condition for this hybrid model to flourish. The teacher is freed from the "assembly line" of grading and lecturing, allowing them to focus on high-touch mentorship.

5. Reconstructing the rural teacher: Three dimensions of agency

We propose three specific role reconstructions for rural teachers in the AI era.

5.1. The epistemic dimension: From "consumer" to "contextual curator" (the digital gatekeeper)

Currently, rural teachers are expected to consume and deliver digital resources provided by the state. This passive role must change. The "contextual curator" actively filters, critiques, and adapts AI-generated content.

The problem: An AI math tutor might explain "interest rates" using examples of stock markets or mortgages—concepts alien to a primary school student in a remote mountainous village.

The reconstruction: The teacher uses their "local knowledge" to intervene. They might use the AI for the calculation mechanics, but wrap it in a project about "calculating the profit of the local apple harvest."

Theoretical support: This study confirms that when teachers act as curators, student engagement significantly increases because the "alien" digital knowledge is "domesticated" into the local lifeworld^[8].

5.2. The pedagogical dimension: From "lecturer" to "algorithmic orchestrator"

In a traditional classroom, the teacher is the "sage on the stage." In an AI-enhanced classroom, the teacher becomes the "guide on the side" or the conductor of an orchestra.

The workflow: The AI system handles the "instruction" (knowledge delivery and quizzing). The teacher handles the "diagnosis" and "remediation."

Data literacy: The teacher must be able to read the Learning Analytics Dashboard. If the AI flags that Student A is struggling with fractions, the teacher does not simply ask them to do more AI quizzes. Instead, the teacher intervenes with physical manipulatives or peer-tutoring.

Orchestration: The teacher decides when to close the laptop and start a group discussion. This requires "meta-pedagogical competence"—knowing the limits of the machine^[9].

5.3. The affective dimension: From "disciplinarian" to "emotional anchor"

This is the most critical function in the context of demographic decline. Rural schools are often filled with students suffering from "parental absence." An AI chatbot can simulate conversation, but it cannot care.

The gap: AI cannot detect the subtle signs of depression or abuse. It cannot offer a hug or a stern look of disappointment rooted in care.

The reconstruction: As AI takes over cognitive load, the teacher should reallocate that time to Social-Emotional Learning (SEL). The teacher becomes a mentor, a surrogate parent, and a role model.

Care ethics: Noddings argues that in a high-tech era, the ethical imperative of "care" becomes the primary definition of the teaching profession. For rural teachers, being an "emotional anchor" is their irreplaceable value proposition against automation^[10].

6. Discussion: Challenges and policy pathways

6.1. The challenge of "techno-stress" and training

Reconstruction is painful. Many rural teachers are older and lack digital confidence. Imposing complex AI systems can lead to "techno-stress" and resistance. Policy Recommendation: Training must shift from "how to use the software" to "how to teach with the software." We need "situated professional development" where training happens in the rural classroom, not in distant conference centers^[11].

6.2. Data sovereignty and ethics

Who owns the data generated by rural students? There is

a risk that rural schools become “data mines” for EdTech companies. Policy recommendation: Government regulations must ensure that the “algorithmic black box” is transparent to teachers. Teachers should have the power to override algorithmic recommendations without penalty^[12].

6.3. Redefining Evaluation Metrics

If we want teachers to be “emotional anchors,” we cannot evaluate them solely on test scores (which AI can optimize better). Policy recommendation: Evaluation systems must include metrics for student well-being, project-based learning outcomes, and community engagement^[13].

7. Conclusion: The “human-in-the-loop” future

The demographic contraction of rural China is an

immutable reality. The rise of AI is an unstoppable force. The intersection of these two trends offers a choice: Option A is a “de-humanized” rural education, where schools are mere holding centers equipped with screens, efficiently delivering standardized content to a shrinking population. Option B is a “re-humanized” rural education. In this vision, AI liberates teachers from drudgery. The rural small-scale school utilizes its “smallness” to offer highly personalized, high-quality education. The teacher stands not as a barrier to technology, but as the essential “human-in-the-loop,” ensuring that the digital future remains grounded in human values and local meaning^[14,15].

Ultimately, the goal of integrating AI into rural schools is not to fix a “broken” system, but to leapfrog into a future where rural students enjoy the best of both worlds: global digital resources and deep local human connection. This transformation rests entirely on the agency of the rural teacher.

Disclosure statement

The author declares no conflict of interest.

References

- [1] National Bureau of Statistics of China, 2023, Statistical Communiqué of the People’s Republic of China on the 2022 National Economic and Social Development, China Statistics Press, Beijing.
- [2] Ministry of Education of the PRC, 2022, 2022 Blue Book on Digital Education in China, People’s Education Press, Beijing.
- [3] Van Dijk JA, 2020, The Digital Divide, Polity Press, Cambridge.
- [4] Wang L, Zhang H, 2023, The Paradox of Connectedness: Digital Infrastructure and Educational Equity in Rural China. *Journal of Rural Studies*, 98: 112–124.
- [5] Knox J, 2021, Artificial Intelligence and Education in China. *Learning, Media and Technology*, 46(3): 252–257.
- [6] Priestley M, Biesta G, Robinson, S, 2021, *Teacher Agency: An Ecological Approach*, Bloomsbury Publishing, London.
- [7] Selwyn N, 2022, The Future of Professionalism in a World of Digital Automation. *Oxford Review of Education*, 48(4): 450–466.
- [8] Li S, Yu S, 2022, Teacher as Curator: Navigating OER in Rural Classrooms. *Computers & Education*, 185: 104523.
- [9] Holstein K, Aleven V, 2022, Designing for Human-AI Complementarity in K-12 Education. *International Journal of Artificial Intelligence in Education*, 32(1): 12–24.
- [10] Noddings N, 2023, Care Ethics in the Digital Age. *Educational Theory*, 73(2): 145–158.
- [11] Yang X, 2024, From Assistant to Partner: The Evolution of Dual-Teacher Classrooms in Western China. *ECNU Review of Education*, 7(1): 45–62.
- [12] Williamson B, Eynon R, 2020, Historical Threads, Missing Links, and Future Directions in AI in Education. *Learning,*

Media and Technology, 45(3): 223–235.

- [13] Zhao Y, Watterston J, 2021, The Changes We Need: Education Post COVID-19. *Journal of Educational Change*, 22(1): 3–12.
- [14] Mandinach EB, Schildkamp K, 2021, Data-Based Decision Making in Education: Challenges and Opportunities. *Studies in Educational Evaluation*, 69: 100871.
- [15] OECD, 2023, *Is Education Losing the Race with Technology? AI's Progress in Maths and Reading*, OECD Publishing, Paris.

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