

AI Education Unplugged: How Can AI in Education Still Work in Underdeveloped Regions with Limited Access to Infrastructure?

Case study based on an interview with Dr. Seiji Isotani and supporting evidence from his published work

This case study is originally based on an interview Qiqing He had with Dr. Seiji Isotani, Faculty Director of the AI and Learning Analytics Program at the University of Pennsylvania Graduate School of Education and President of the International Artificial Intelligence in Education Society. It is an original analytical synthesis of that interview, together with cited project materials and published sources. For Dr. Seiji's profile information, see <https://www.gse.upenn.edu/faculty/seiji-isotani> and <https://scholar.google.com/citations?user=GKphfGsAAAAJ>.

Executive Summary

Artificial Intelligence in Education (AIED) can expand access to personalized support, immediate feedback, and new forms of teaching and learning. Yet those benefits are unevenly distributed. In the interview, Dr. Seiji Isotani argues that mainstream AIED often assumes reliable internet, sufficient hardware, and digitally fluent users—conditions that many communities do not have. In that sense, AIED can become a new source of educational inequality unless its design changes.

This case study examines how the concept of AI Education Unplugged was translated into practice in Brazil through a writing-focused learning-recovery effort under the country's National Policy on Learning Recovery. Rather than waiting for ideal infrastructure, the intervention started from what already existed: paper-based student work, widespread access to mobile phones, and limited but usable internet access for administrative purposes inside schools.

The result was an asynchronous workflow in which student essays were photographed, uploaded whenever connectivity became available, processed with AI techniques, and returned to teachers as dashboards and diagnostic feedback. According to the interview and associated project materials, this model reduced time, cost, and complexity relative to the previous essay-review process and operated at very large scale, with reported positive patterns in both writing improvement and equity-oriented subgroup comparisons.

1. Why this case matters

The dominant public conversation about educational AI is often shaped by high-resource assumptions: one device per learner, stable broadband, digitally fluent teachers, and direct student interaction with advanced AI systems. Dr. Isotani's interview challenges that model directly by asking a more globally relevant question: how can the benefits of AI be brought to people and places where technology and infrastructure are almost not available?

How can we **bring the benefits of AI**
to people and places **where**
technology and infrastructure are
(almost) **not available?**

Figure 1. Core framing question of the interview and presentation

Source: Interview presentation materials shared by Dr. Seiji Isotani (2026).

The project's macro argument is that unequal AI readiness is itself becoming an educational problem. One presentation slide, drawing on Isotani et al. (2023), states the claim starkly: with the widespread impact of AI technology in education, AIED has become a new source of educational inequality.

With the widespread impact of AI technology in
Education, **AIED has become the new source
of educational inequality**

Isotani et al. (2023)

Isotani, S., Bittencourt, I. I., Chalco, G. C., Dermeval, D., & Mello, R. F. (2023, June). Aied unplugged: Leapfrogging the digital divide to reach the underserved. In *International Conference on Artificial Intelligence in Education* (pp. 772-779). Cham: Springer Nature Switzerland.

Figure 2. AIED as a new source of educational inequality

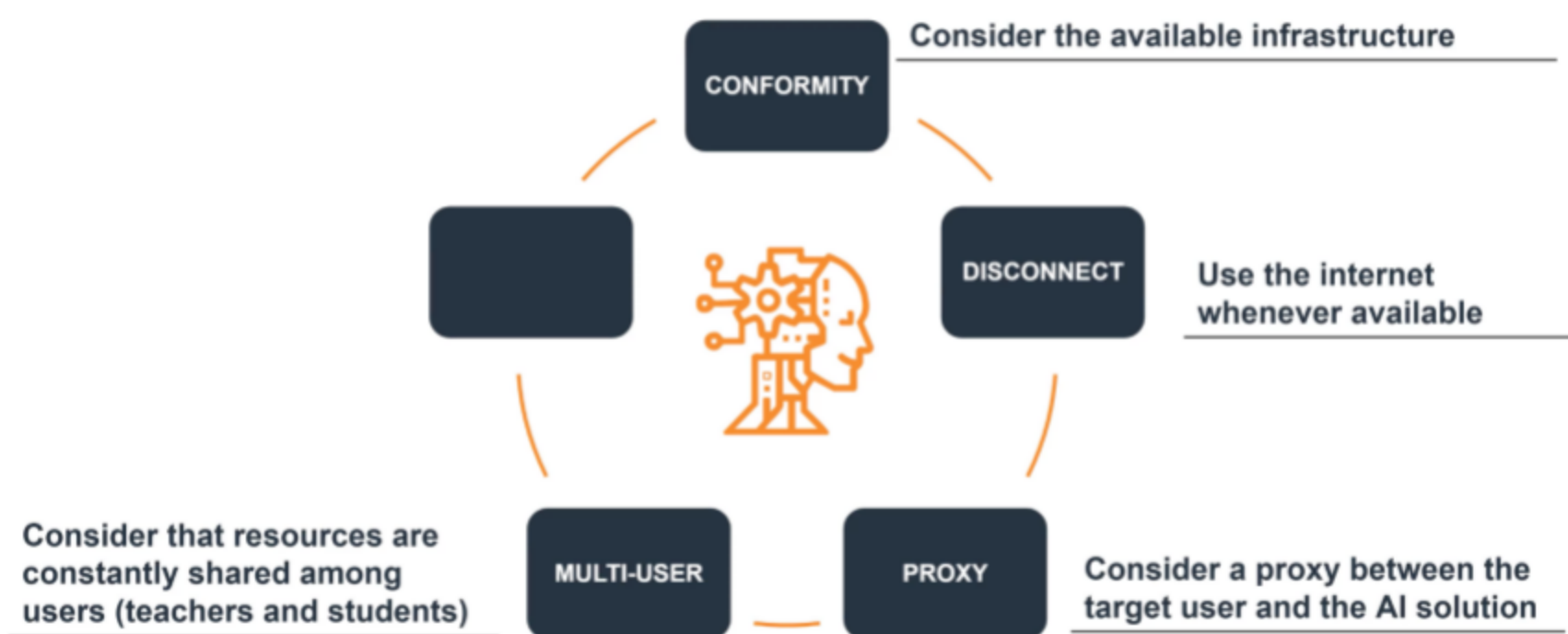
*Source: Isotani, S., Bittencourt, I. I., Chalco, G. C., Dermeval, D., & Mello, R. F. (2023). AIED unplugged: Leapfrogging the digital divide to reach the underserved. In *International Conference on Artificial Intelligence in Education* (pp. 772–779). Springer Nature Switzerland.*

2. AIED Unplugged as a design framework

AI Education Unplugged is not simply a cheaper version of mainstream AIED. It is a different design philosophy. Instead of assuming continuous connectivity, one-to-one device access, and direct student interaction with AI, it starts from the constraints that underserved regions actually face.

Across the interview and presentation, five recurring principles define this framework: begin with the infrastructure that already exists; use the internet only whenever it is available; assume that devices and resources are shared; place a proxy such as a teacher between the AI system and the target learner when appropriate; and avoid adding unnecessary digital-skill requirements to already burdened users.

AIED Unplugged: Technology for Resource-Constrained Environments

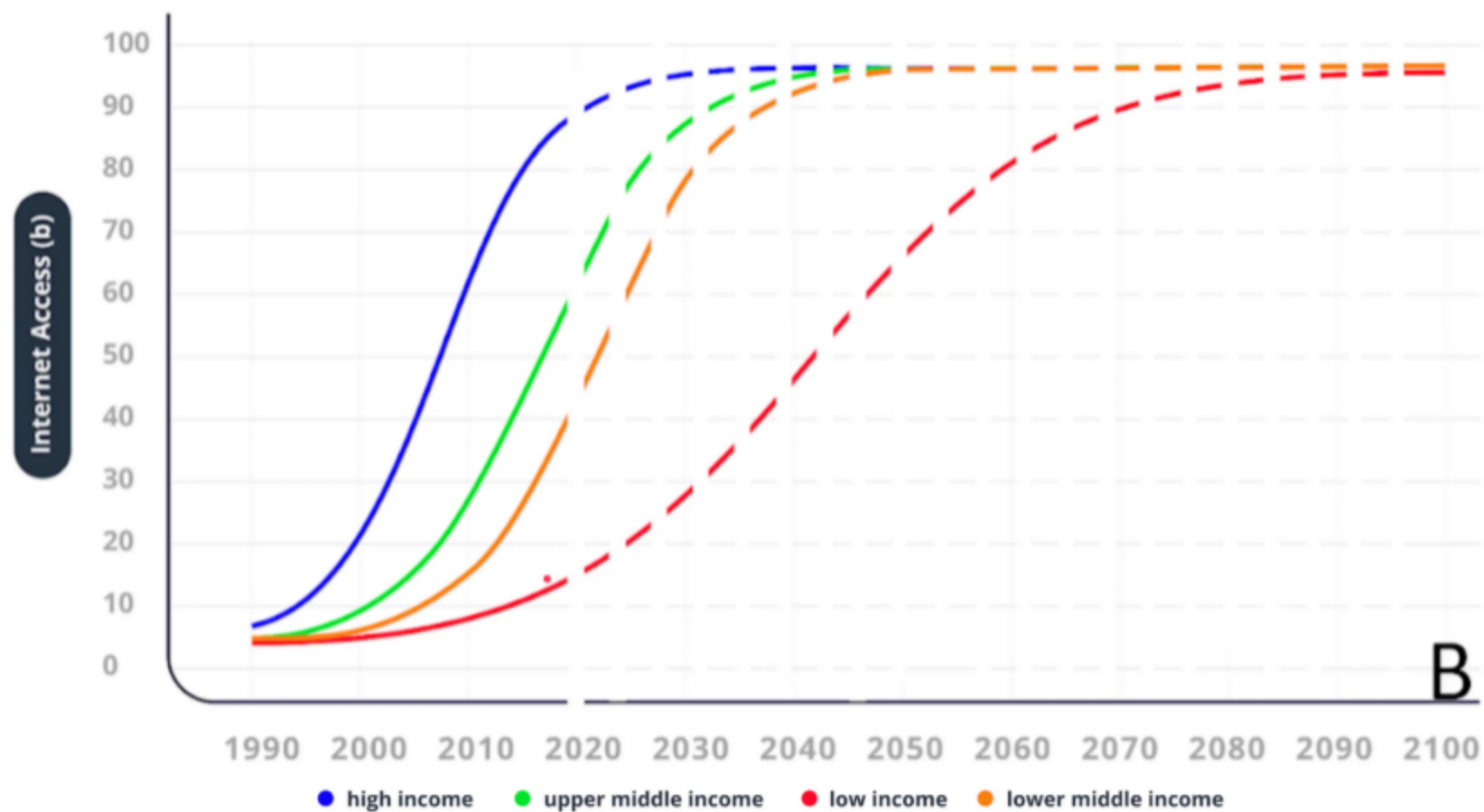


Isotani, S., Bittencourt, I. I., Chalco, G. C., Dermeval, D., & Mello, R. F. (2023, June). Aied unplugged: Leapfrogging the digital divide to reach the underserved. In *International Conference on Artificial Intelligence in Education* (pp. 772-779). Cham: Springer Nature Switzerland.

Figure 3. AIED Unplugged principles for resource-constrained environments

Source: Isotani, S., Bittencourt, I. I., Chalco, G. C., Dermeval, D., & Mello, R. F. (2023). *AIED unplugged: Leapfrogging the digital divide to reach the underserved*. In *International Conference on Artificial Intelligence in Education* (pp. 772-779). Springer Nature Switzerland.

One of the framework's key empirical claims is that cellphone access in low-income communities is far higher than stable internet access. At the same time, internet convergence remains slow enough that many low-income systems cannot simply wait to catch up. This is why the design logic emphasizes asynchronous and mobile-mediated use rather than always-online classroom models.



Isotani, S., Bittencourt, I. I., Chalco, G. C., Dermeval, D., & Mello, R. F. (2023, June). Aied unplugged: Leapfrogging the digital divide to reach the underserved. In *International Conference on Artificial Intelligence in Education* (pp. 772-779). Cham: Springer Nature Switzerland.

Figure 4. Slow internet-access convergence in low-income communities

Source: Isotani, S., Bittencourt, I. I., Chalco, G. C., Dermeval, D., & Mello, R. F. (2023). *AIED unplugged: Leapfrogging the digital divide to reach the underserved*. In *International Conference on Artificial Intelligence in Education* (pp. 772-779). Springer Nature Switzerland.

3. Brazil's learning-recovery policy as the implementation context

The conceptual framework became operational in Brazil after the COVID-19 pandemic. In the interview, Dr. Isotani explained that the Brazilian government sought to support learning recovery—especially in reading, mathematics, and writing—without increasing the burden on already overloaded teachers.

The presentation places the work inside Brazil's National Policy on Learning Recovery, established in 2022. For this session, Dr. Isotani narrowed the focus to writing because Portuguese proficiency data showed a serious and persistent problem, especially by the end of lower secondary school.

FOCUS OF TODAY'S PRESENTATION

National Policy of Learning Recovery



Develop reading, math, and writing skills of Brazilian students

Figure 5. Brazil's National Policy on Learning Recovery and focus on writing

Source: Brasil. Decreto nº 11.079, de 23 de maio de 2022, which instituted the National Policy for Learning Recovery in Basic Education; slide context from interview presentation materials shared by Dr. Seiji Isotani (2026).

In the interview, Dr. Isotani described the baseline challenge as severe: around half of students completed fifth grade with adequate Portuguese knowledge, while only about 35% of ninth-grade students did so. The presentation materials support this diagnosis with SAEB-linked indicators showing weak and deteriorating Portuguese proficiency after the pandemic period.

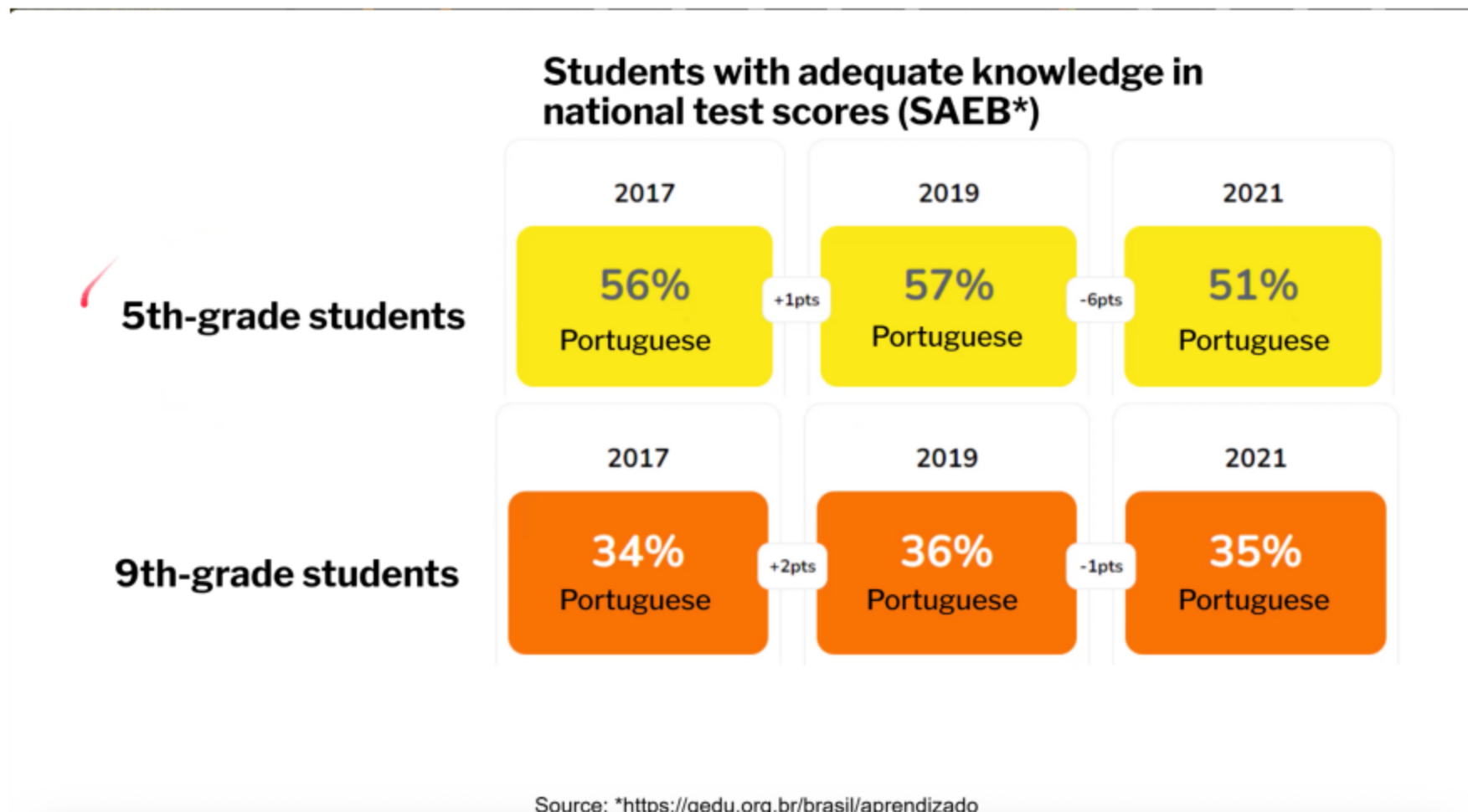


Figure 6. Baseline Portuguese proficiency among Brazilian students

Source: QEdU (slide citation shown in interview presentation materials shared by Dr. Seiji Isotani, 2026).

4. The previous model and its bottlenecks

The case is especially strong because it contains a visible before-state. Before the AI Unplugged redesign, students wrote essays on paper; essays were scanned or mailed to a university; peer or university-based evaluators reviewed them; and results were sent back to schools.

According to both the interview and presentation, this model suffered from four major weaknesses: high cost, need for teacher training, complaints about system usability and lack of support, and a delay of four to six months before feedback returned. That delay meant the process was often no longer pedagogically useful by the time teachers and students received results.

The previous model: status quo

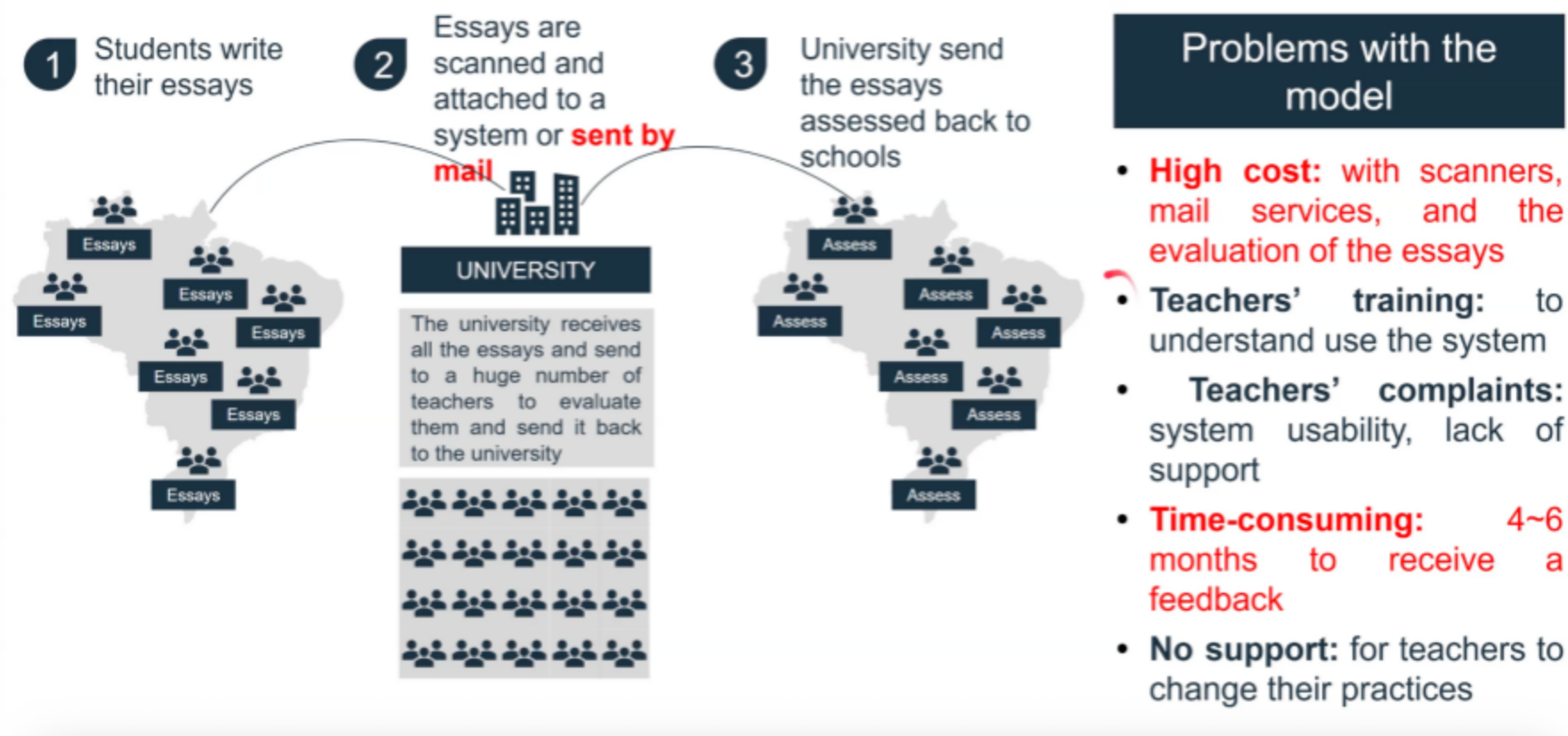


Figure 7. The previous essay-review model and its operational problems

Source: Interview presentation materials shared by Dr. Seiji Isotani (2026), summarizing the pre-existing review workflow described in the interview transcript.

5. The redesigned workflow: asynchronous, mobile, teacher-facing

The intervention that followed did not attempt to digitize the classroom in a conventional one-device-per-student way. Instead, it kept student work on paper, used a low-cost mobile scanning application to capture essays, uploaded images whenever internet became available, processed them through AI-supported analysis, and returned diagnosis to teachers.

The crucial institutional insight was that schools often lacked reliable classroom internet but still had enough connectivity for administrative purposes—frequently in the principal's office—to support delayed upload. This made asynchronous processing realistic even in weak-infrastructure environments.



Figure 8. Operational workflow from paper-based activity to AI diagnosis

Source: Interview presentation materials shared by Dr. Seiji Isotani (2026), reflecting the implementation model described in the interview and associated project outputs.

Importantly, the primary user of the returned diagnosis was the teacher, not the student. The system provided class-level and student-level information, as well as guidance on what was strong, what needed improvement, and what pedagogical actions might be appropriate. In other words, the intervention treated AI as a mechanism for augmenting teacher capacity rather than replacing teacher judgment.

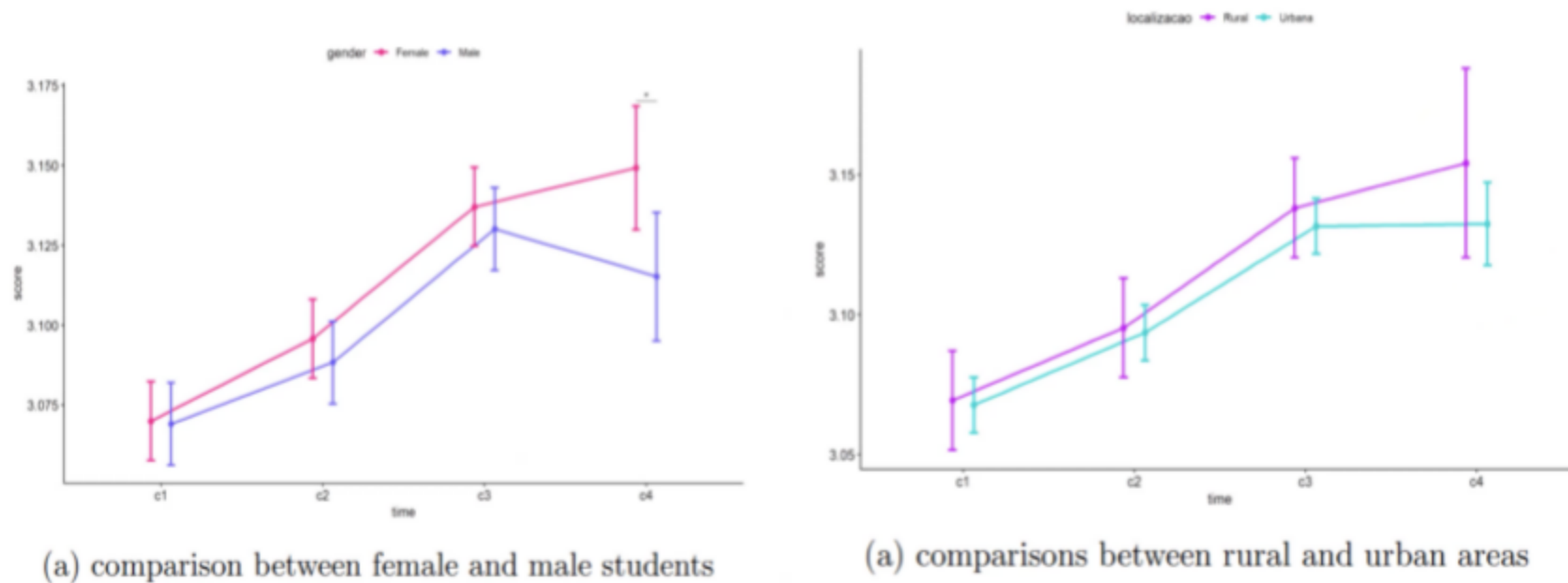
6. Scale and reported outcomes

The interview and project materials report implementation at remarkable scale: more than 500,000 students, 7,000 schools, and 20,000 teachers. The associated AIED Unplugged paper abstract shown in the slides similarly reports a positive impact on more than 500,000 students in 7,000 schools in Brazil.

The project materials also report encouraging impact patterns. The charts shown during the session suggest improvement in writing-skill scores over time, while subgroup comparisons indicate no meaningful disadvantage by gender and relevant equity-oriented comparisons across rural and urban areas.

Impact Analysis

Improving learning and equity



Portela, C., Palomino, P. ... Isotani, S. (2024) AI in Education Unplugged Support Equity Between Rural and Urban Areas in Brazil. International Conference on Information & Communication Technologies and Development (ICTD), 1 – 17.

Figure 9. Reported impact analysis on learning and equity

Source: Portela, C., Palomino, P., ... & Isotani, S. (2024). AI in Education Unplugged Support Equity Between Rural and Urban Areas in Brazil. International Conference on Information & Communication Technologies and Development (ICTD), 1–17.

These findings should be stated carefully. Based on the materials gathered here, they support the claim that the project found promising evidence of improved writing outcomes and equity-relevant effects. Stronger methodological claims would require direct inspection of the full underlying papers and appendices.

7. Analytical takeaway

The deeper significance of this case is strategic rather than merely technical. Its apparent success did not come from deploying the most advanced AI under ideal conditions. It came from redesigning educational AI around real constraints: teacher overload, weak student-side infrastructure, intermittent connectivity, and the need for policy fit rather than technological prestige.

That makes this case important far beyond Brazil. It suggests that in low-resource settings, educational AI may be most effective when it is teacher-facing, asynchronous, mobile-mediated, and tightly integrated with public-policy goals. In that sense, AI Education Unplugged is best understood as a model of design under scarcity.

At the same time, the case should not be overstated. The strongest version of the argument is that AIED Unplugged offers a credible and policy-relevant path for educational AI in underserved settings; it is not yet evidence that every such system will replicate Brazil's results automatically.

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