Improving the quality of education in developing countries:

An experimental evaluation of teacher training programs in El Salvador

Carla Coccia
Department of Economics
University of Bern

Martina Jakob
Department of Economics
University of Zurich

Konstantin Büchel
Research
Youth Impact

Ben Jann
Institute of Sociology
University of Bern

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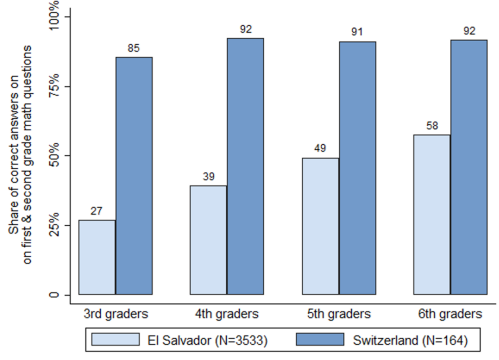
Motivation: Student learning outcomes



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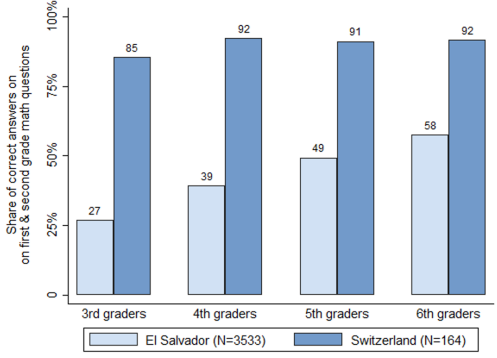

Teachers: Subject-matter gaps

- In Morazán, teachers answer less than half of primary-level questions correctly.
- Only 14% are sufficiently prepared to teach mathematics. [Brunetti et al., 2024]

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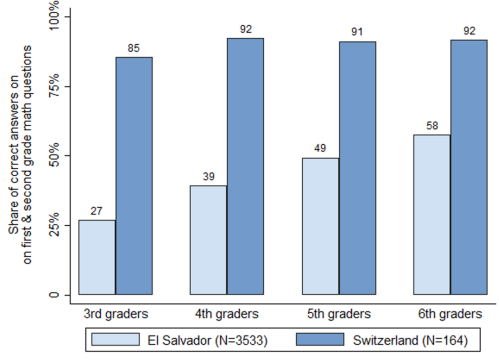

Teachers: Subject-matter gaps

- In Morazán, teachers answer less than half of primary-level questions correctly.
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Teachers: Pedagogical gaps

- Teaching often follows a rigid chalk-and-talk approach.
- Focus on covering the curriculum, not children's learning progress.

Intervention

RCT with three parallel six-month teacher trainings with different focuses

Details

Intervention

RCT with three parallel six-month teacher trainings with different focuses

1. Math Content

Focus on primary-level math knowledge

Examples:
number sense, fractions, operations, geometry

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number sense, fractions, operations, geometry

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Focus on general pedagogical methods

Examples:
methodological pacing, planning, differentiation, feedback

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RCT with three parallel six-month teacher trainings with different focuses

1. Math Content

Focus on primary-level math knowledge

Examples:
number sense, fractions, operations, geometry

2. Pedagogy

Focus on general pedagogical methods

Examples:
methodological pacing, planning, differentiation, feedback

3. Combined

A combination of trainings 1. and 2.

Examples:
methodological pacing, differentiation, number sense, operations

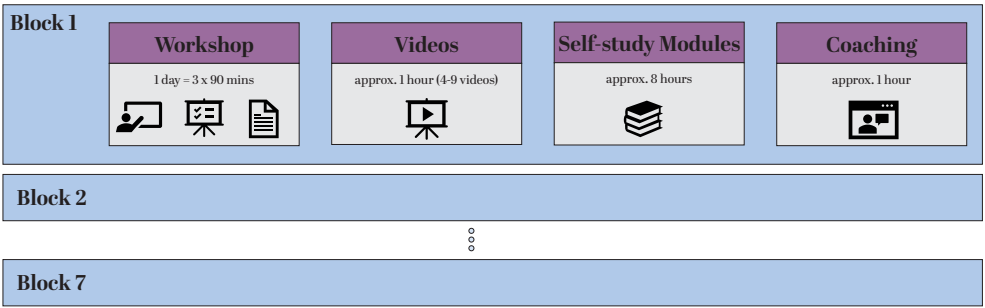
Details

Contribution

- Contributes to closing the evidence gap on teacher trainings in developing countries
- Almost no evidence on content-based teacher training
- First paper to compare content and pedagogical training interventions

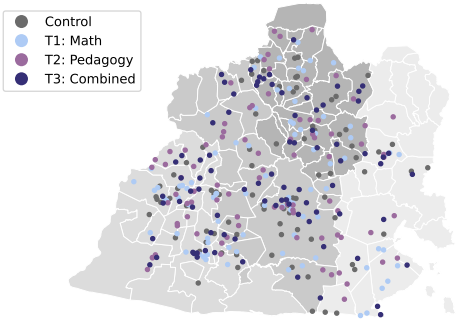
Literature

Intervention details



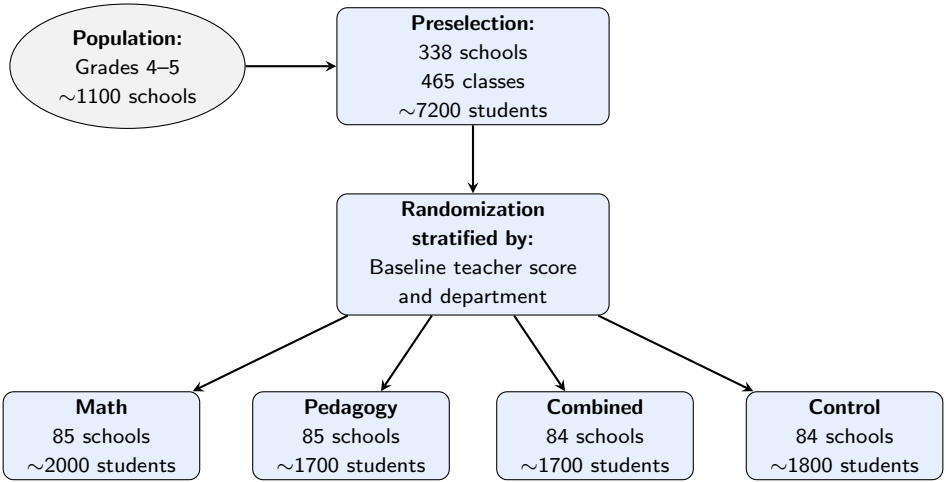
Sample and school locations

Sample departments

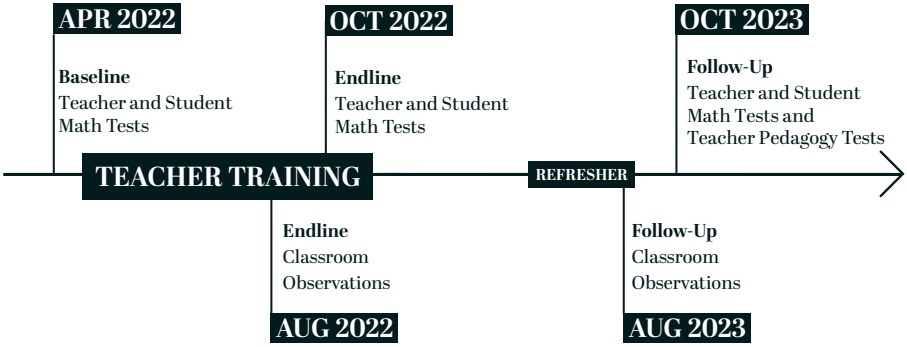


School locations

Sample and randomization



Timeline and data



Data

Estimation strategy

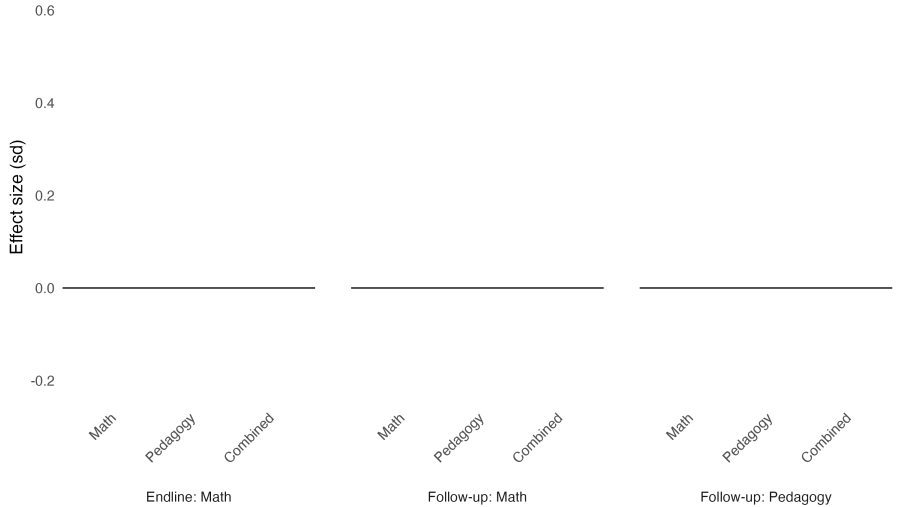
Treatment effect on test scores for each post-treatment $wave \in \{endline, follow-up\}$:

$$Y_{st}^{wave} = \beta_1 T_{Math} + \beta_2 T_{Ped} + \beta_3 T_{Combo} + \delta Y_{st}^{baseline} + \mu_s + \epsilon_{st} \quad (1)$$

- Y_{iv}^{wave}: endline/follow-up math scores of student s of teacher t
- $T_{Math}/T_{Ped}/T_{Combo}$: indicators for math, pedagogy and combined treatment
- $Y_{iv}^{baseline}$: baseline math score
- μ_s: strata fixed effects
- Standard errors clustered at the teacher level

Baseline characteristics

Were there changes in teacher knowledge?



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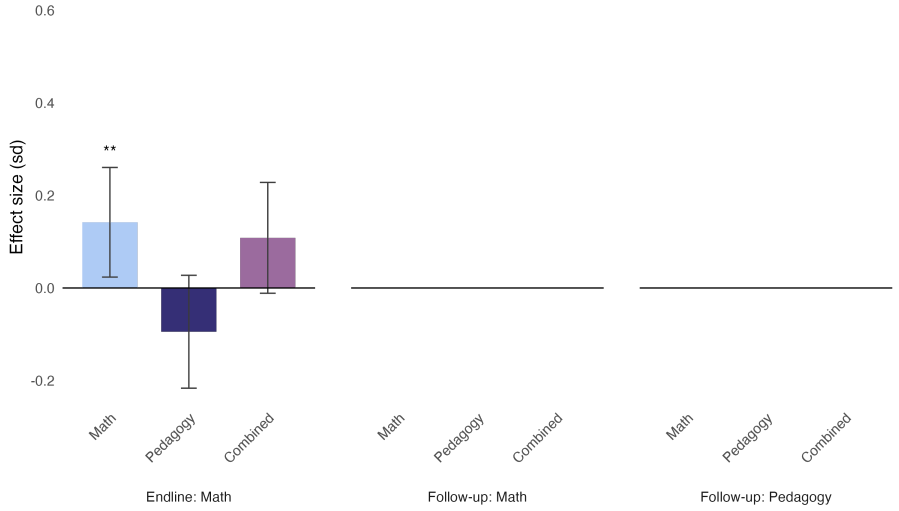

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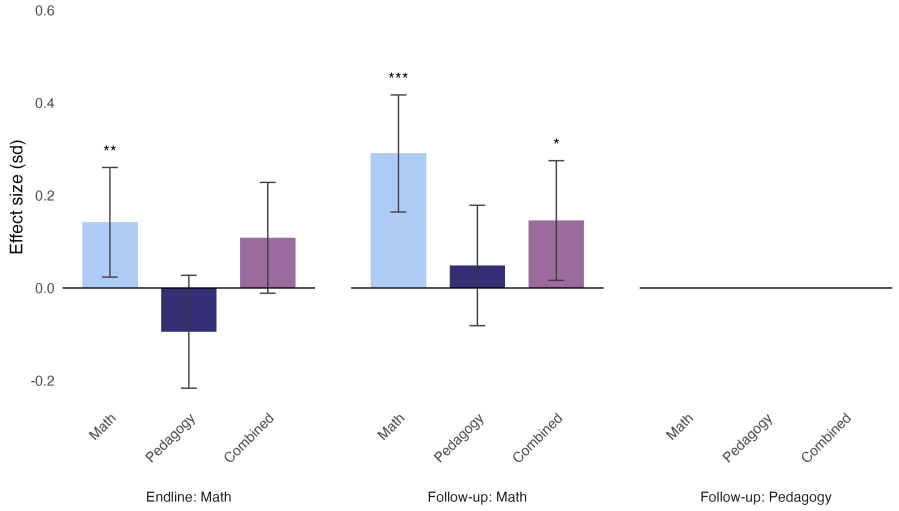

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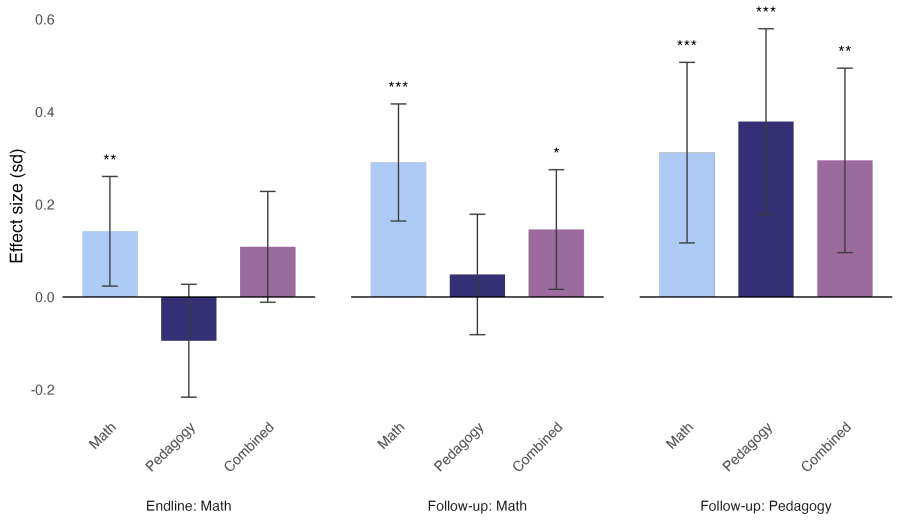
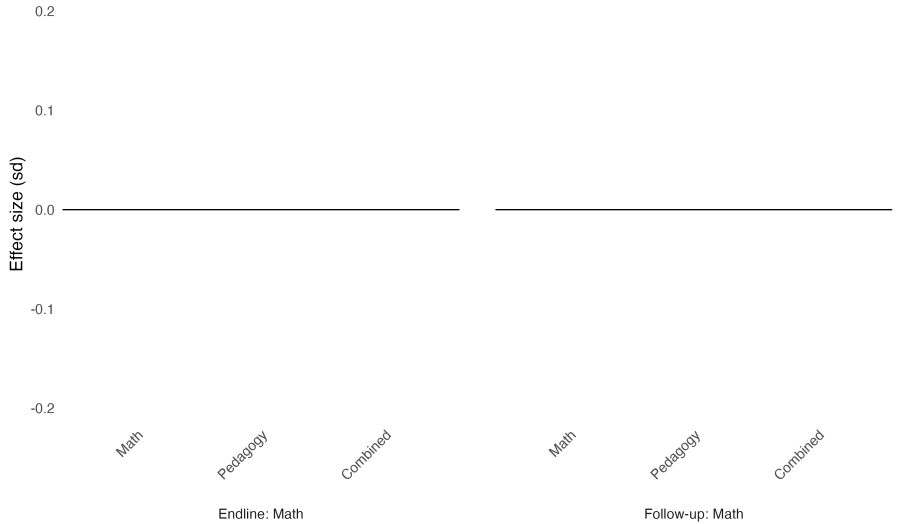


Were there changes in student knowledge?



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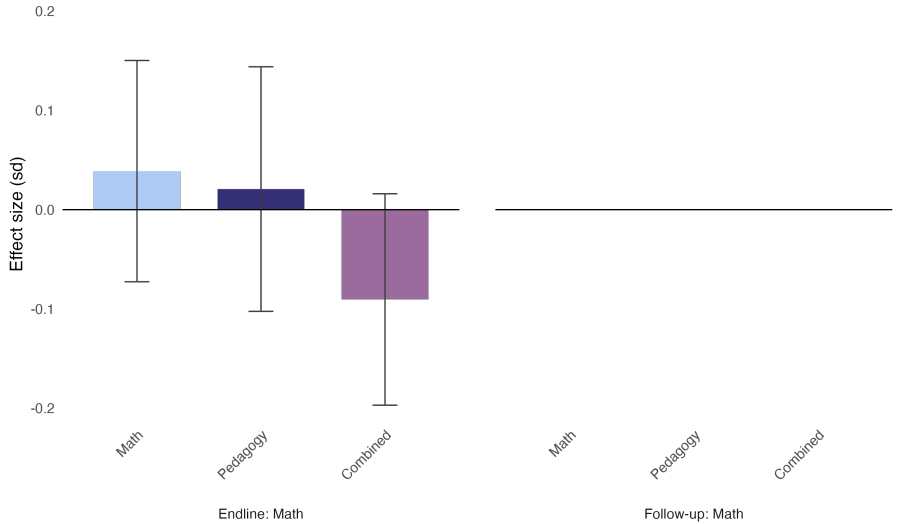

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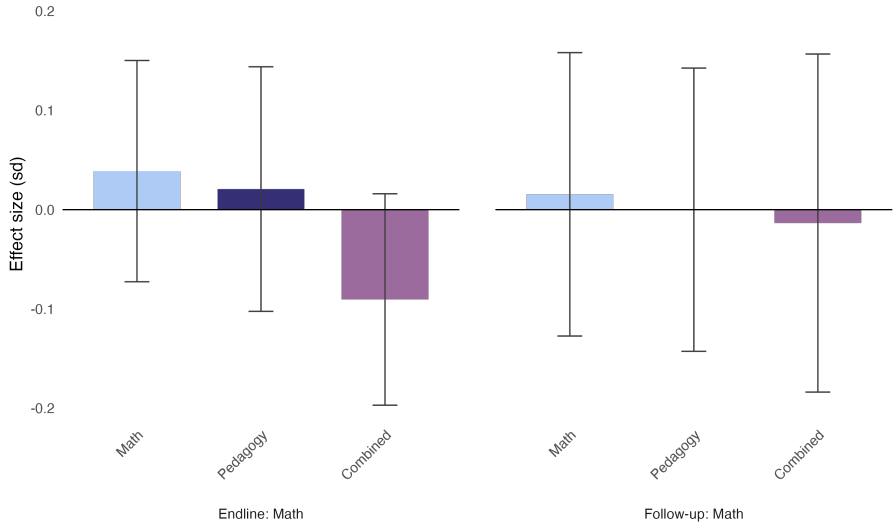
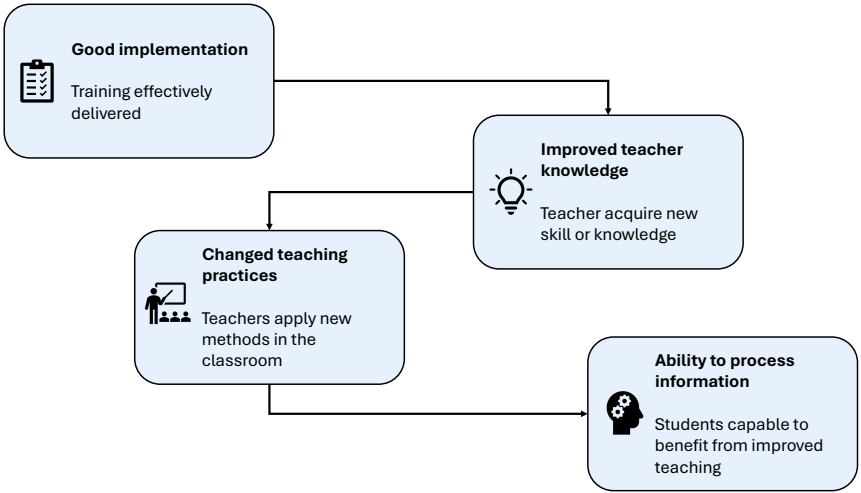


From implementation to impact



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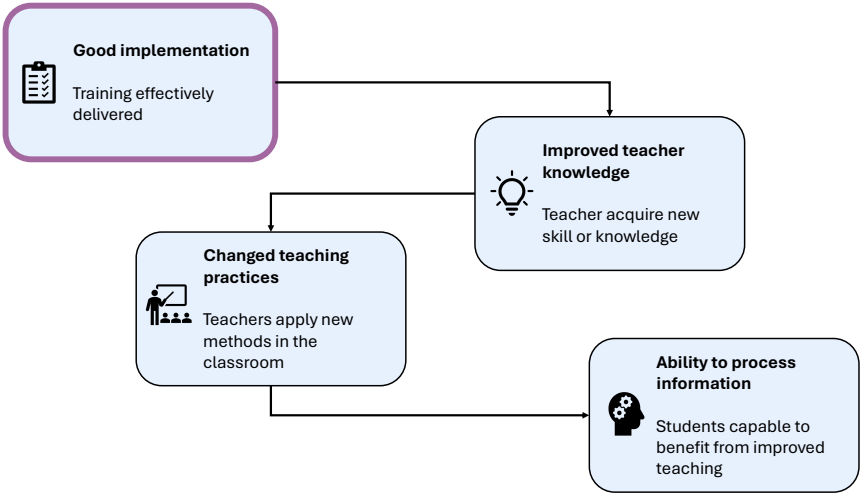

Implementation

"I really liked that on each day the lesson took place, concrete materials were always used. We deepened the learning, for example, through games or by manipulating objects."

– Ana (Combination)

"The children really liked the games and everything, they are more motivated. [...] All of that helped us to motivate the children more."

– Jesús (Pedagogy)

"It was very important to me because I acquired new knowledge, and it's such a great tool that they gave us teachers [...] that helped us a lot in the classroom."

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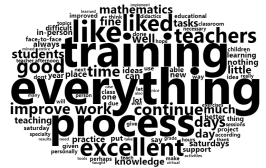

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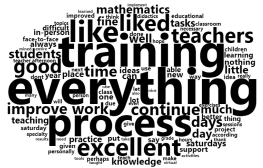
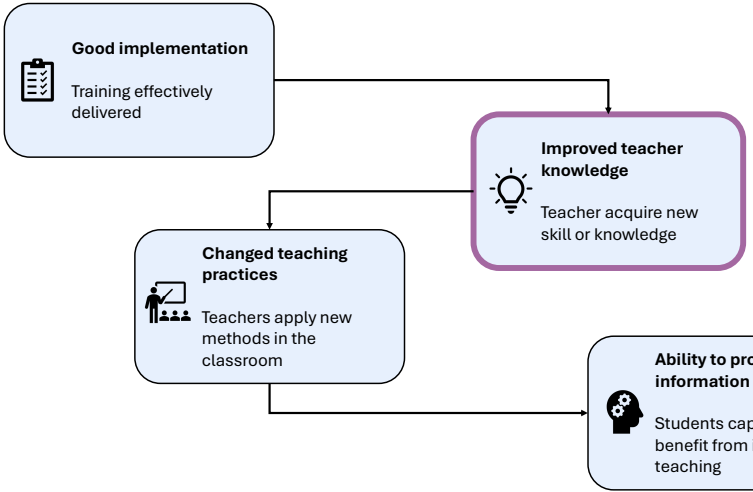


Word	Frequency
excellent	12
liked	11
fine	10
good	10
like	3
nice	3
seemed	3

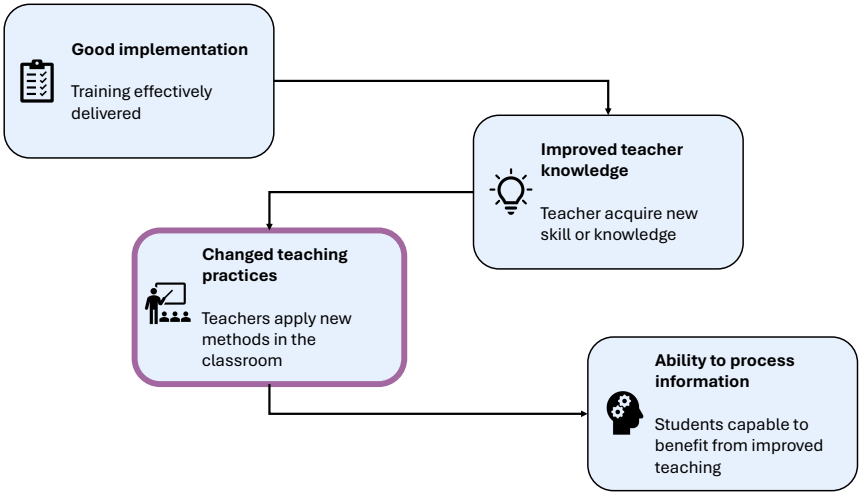
Compliance

From implementation to impact

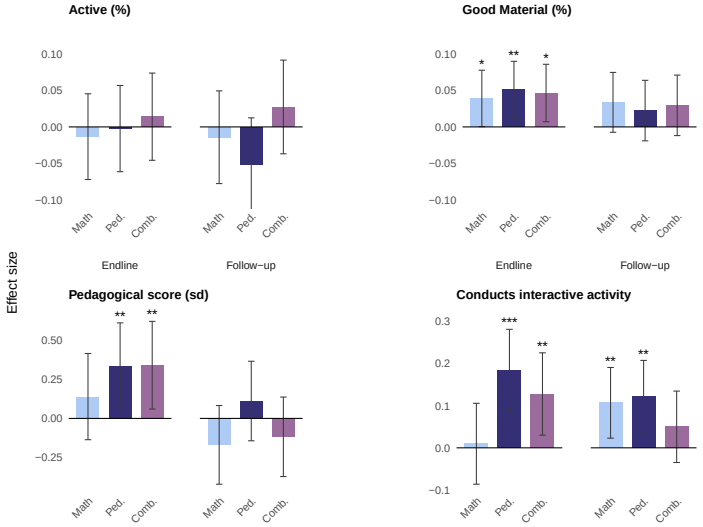


Details

From implementation to impact



What happened in the classrooms?



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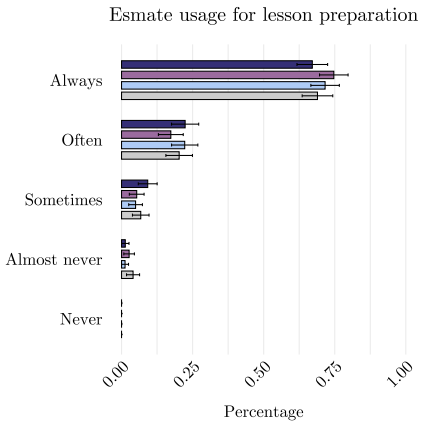

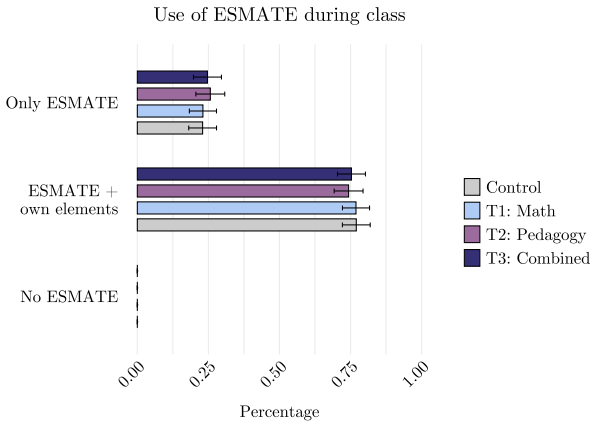

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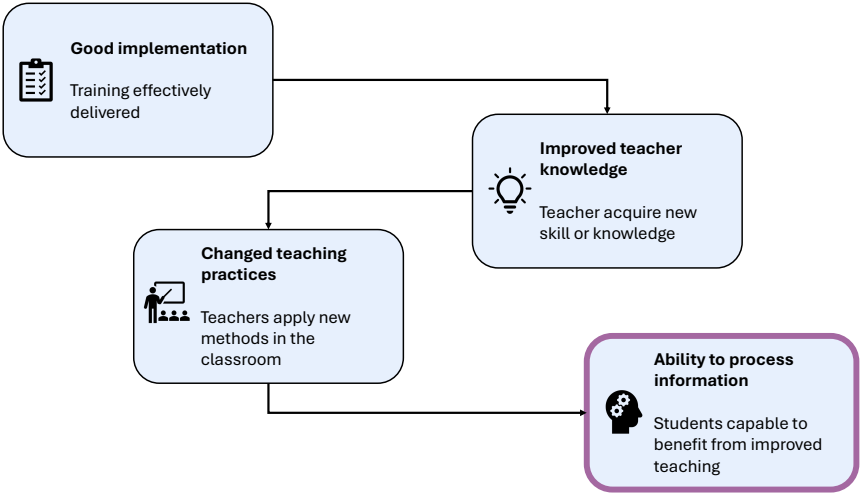
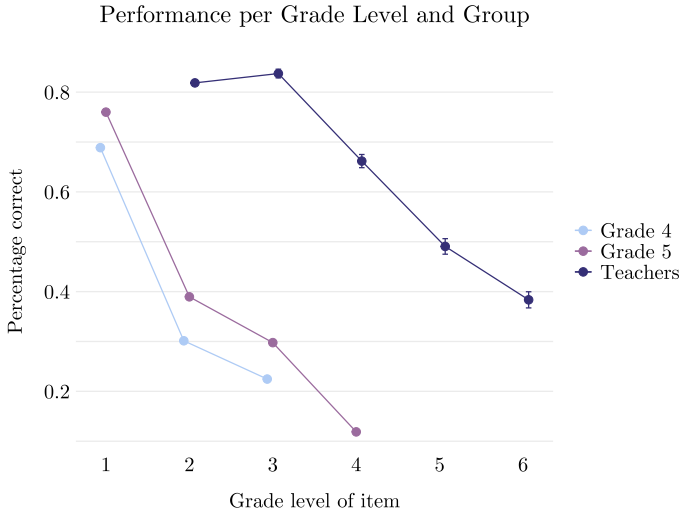
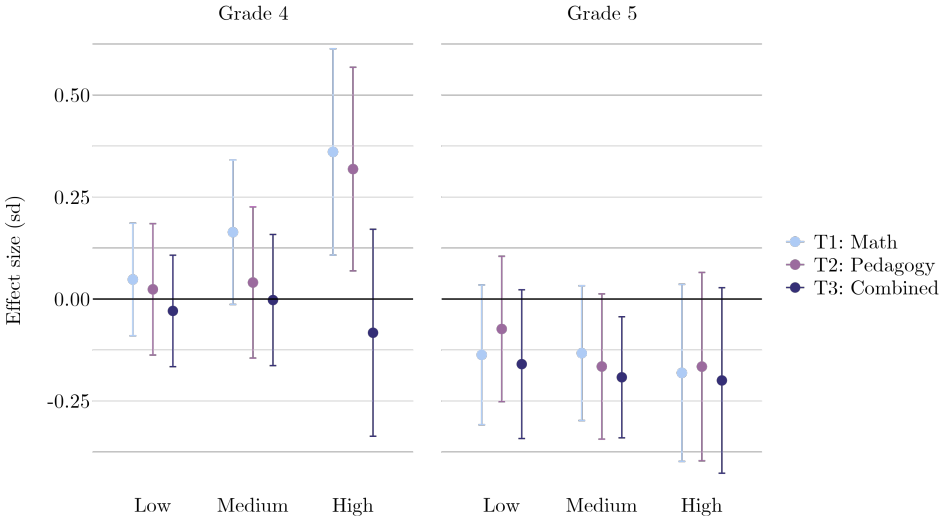


Students' learning deficit



Heterogeneity at endline



Conclusion

- The effectiveness of teacher training programs in developing countries is highly context-dependent. In our case, despite significant improvements in teacher knowledge, student learning outcomes remained low.
- Structural constraints (e.g., rigid curricula and pacing guides) can limit the classroom impact of pedagogical training.
- Training teachers in higher grades may yield limited results due to large pre-existing learning deficits among students.
- Efforts should prioritize addressing early learning deficits as efficiently as possible.

Appendix

Program details

Math Focus: Mathematical content knowledge	Pedagogy Focus: Teaching didactic skills	Combined Focus: Math and pedagogical training
1. The world of numbers	1. Elements of good teaching	1. Elements of good teaching
2. Basic operations	2. Methodological pacing (part 1)	2. Methodological pacing
3. Fractions	3. Methodological pacing (part 2)	3. Differentiation
4. Basic operations with fractions	4. Planning	4. The world of numbers
5. Decimals	5. Differentiation	5. Basic operations
6. Geometry	6. Classroom management	6. Decimals
7. Statistics	7. Feedback	7. Geometry

Back

Evidence on teacher training programs

- Evidence scarce, but largely positive [Cilliers et al., 2020, Kerwin and Thornton, 2021, Piper et al., 2018]
- Some evidence of sustained impact in follow-up cohorts [Cilliers et al., 2020]
- Interventions are often bundled with additional components (textbooks, structured lesson plans, technology, contract or volunteer teachers, incentives, etc.) [Popova et al., 2022, McEwan, 2015]
- What works best? [Popova et al., 2022]
  - Focus on a specific subject
  - Initial face-to-face training
  - Lesson enactment in the training
  - Career incentive

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Experimental design: Data

Teacher Data

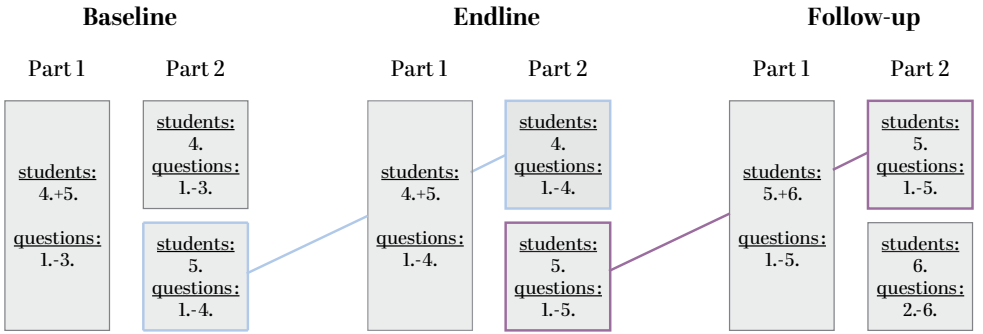
- **Tests**
  - Math (3x): 40 items, curriculum-based
  - Pedagogy (1x): Lesson plan + classroom management task
- **Observations (2x)**
  - Stallings instrument (snapshots)
  - Additional pedagogy indicators
- **Surveys & Logs**
  - Motivation, confidence, perceptions
  - Workshop attendance, module completion

Student Data

- **Math tests (3x)**
  - 40 items: 20 shared + 20 grade-specific
  - 60 minutes, curriculum-based
- **Survey**
  - Background, motivation, subject preferences

Back

Experimental design: Assessment structure



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Compliance

Table 1: Compliance Statistics

Attended one or more (%)	Completed workshops	Completed online activities	Completed homework sets
0.81	4.75	4.56	5.01

The total number of activities for each block is 7.

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Teacher content knowledge and student learning gains

Table 2: Teacher content knowledge and student learning gains: Evidence from quasi-experimental data

Study	Student Effect ($+ 1\sigma$ teacher score)	Country/Region	Grade	Empirical Strategy
Metzler and Woessmann (2012)	Math: 0.09, Language: 0.03 (insig.)	Peru	Grade 6	Teacher FE + Student FE
Bietenbeck, Piopiunik, and Wiederhold (2018)	Mixed: 0.03	6 East African countries	Grade 6	Teacher FE + Student FE
Bold et al. (2019)	Mixed: 0.07	7 African countries	Grade 4	Teacher FE + Student FE
Bau and Das (2020)	Math: 0.09, Language: 0.06	Pakistan, Punjab	Grade 3-5	Teacher value-added approach
Brunetti et. al (2023)	Math: 0.09–0.12	El Salvador, Morazán	Grade 3- 6	Various controls
Our results	Math: 0..07-0.08	El Salvador, Morazán	Grade 4-6	Various controls

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Balance Table

Table 3: Balance at Baseline

	Control	T1: Math	T2: Pedagogy	T3: Combined	P-value	N
Teacher variables						
Baseline score	0.59	0.61	0.63	0.61	0.04	338
Is math teacher	0.04	0.12	0.13	0.11	0.17	338
Share female	0.64	0.62	0.59	0.64	0.86	338
Age	45.60	47.90	46.86	46.14	0.42	336
Years of experience	10.37	11.21	13.59	11.29	0.17	338
Class variables						
Class size	15.29	16.87	15.16	15.76	0.58	333

Literature i

A. Brunetti, K. Büchel, M. Jakob, B. Jann, and D. Steffen. Inadequate teacher content knowledge and what could be done about it: evidence from el salvador. *Journal of Development Effectiveness*, 16(2):206–229, 2024.

J. Cilliers, B. Fleisch, C. Prinsloo, and S. Taylor. How to improve teaching practice?: an experimental comparison of centralized training and in-classroom coaching. *Journal of Human Resources*, 55(3):926–962, 2020.

J. T. Kerwin and R. L. Thornton. Making the grade: The sensitivity of education program effectiveness to input choices and outcome measures. *Review of Economics and Statistics*, 103(2):251–264, 2021.

P. J. McEwan. Improving learning in primary schools of developing countries: A meta-analysis of randomized experiments. *Review of educational research*, 85(3):353–394, 2015.

B. Piper, S. S. Zuilkowski, M. Dubeck, E. Jepkemei, and S. J. King. Identifying the essential ingredients to literacy and numeracy improvement: Teacher professional development and coaching, student textbooks, and structured teachers' guides. *World Development*, 106:324–336, 2018.

A. Popova, D. K. Evans, M. E. Breeding, and V. Arancibia. Teacher professional development around the world: The gap between evidence and practice. *The World Bank Research Observer*, 37(1):107–136, 2022.