

Are Teachers and Learning Software Complements or Substitutes?

Evidence from a Randomized Experiment in El Salvador

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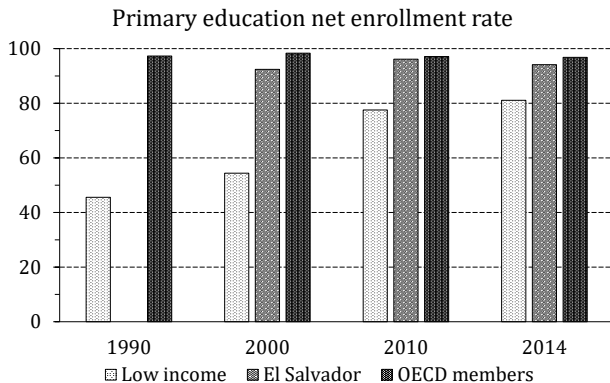
November 12, 2018

- Motivation & context of the study
- Literature & contribution
- CAL intervention in El Salvador
- Study design
- Next steps

Motivation

Two stylized facts

- 1 Impressive increases in primary education enrollment in developing countries

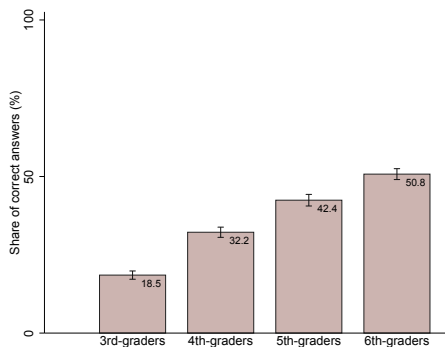


Data source: World Bank

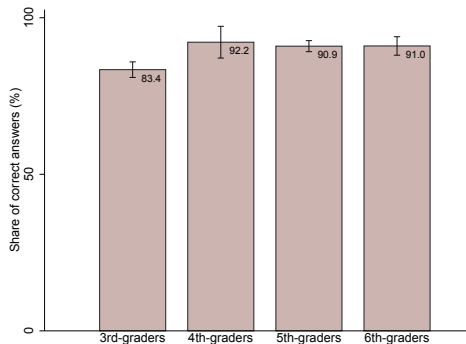
Motivation

Two stylized facts

2 Poor learning outcomes



(a) El Salvador (Morazán), N=3461



(b): Switzerland (Bern), N=164

Figure: Bar graphs (with 80% confidence intervals) show share of correct answers to 2nd grade math questions, Source: own data.

Motivation

Two stylized facts

2 Poor learning outcomes

c. $8 \div 2 = \underline{\hspace{2cm}}$

Pregunta 18

¿Qué hora marca el reloj?



La hora es ____ : ____

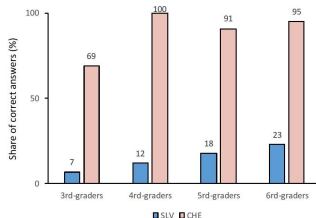
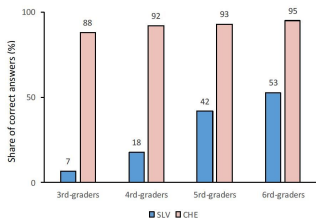


Figure: Bar graphs show share of correct answers to 2nd grade math questions, Source: own data.

Motivation

What happens in the classroom?

❶ Children spend relatively little time in school

- Only morning *or* afternoon classes in El Salvador
- Cancellation of many school lessons

→ 1000 unannounced visits: 26% of all lessons are not held!

❷ Low teaching quality

- Large and heterogeneous classes
- Outdated pedagogy focusing on memorization and reproduction
- Low qualification and/or motivation of teachers

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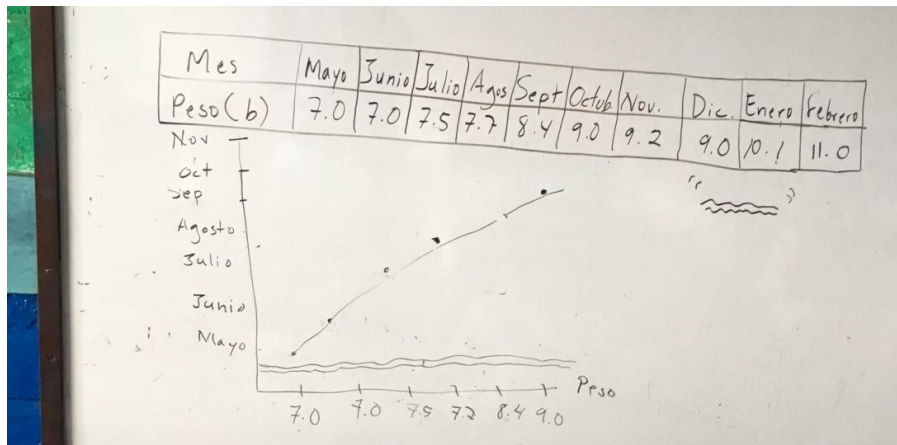
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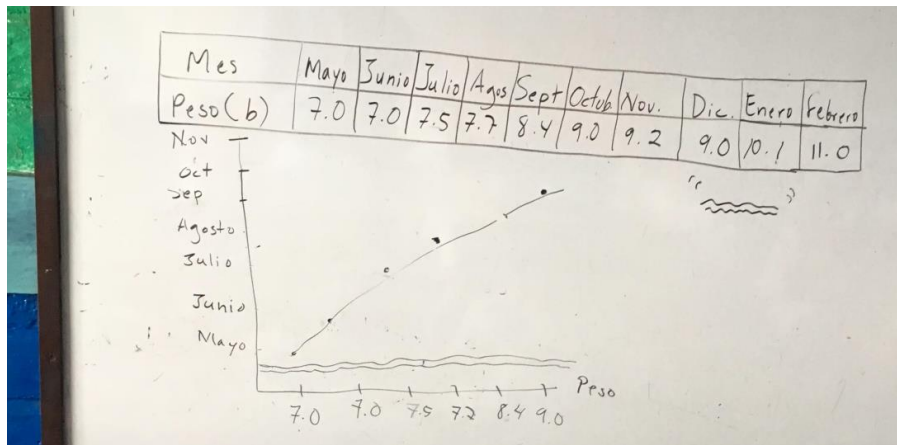
What happens in the classroom?



→ How can these problems be addressed?

Motivation

What happens in the classroom?



→ How can these problems be addressed?

Motivation

What can be done?

- ① Expand school time
- ② Computer-assisted learning (CAL)
 - Self-paced learning
 - Start at a very low level
 - Less sensitive to teacher quality

Previous literature mainly focuses on Asia

- e.g. Banerjee et al. (2007), Muralidharan et al. (2017) in India
- e.g. Yang et al. (2012), Mo et al. (2014) in China

Our contribution

- What is the main causal channel? Are learning gains mainly attributable to...
 - a. ... use of a software
 - b. ... additional lessons?
- How can CAL-lessons be implemented cost-effectively?
 - I.e. Are teachers and software substitutes or complements?
- External validity: New software and context

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CAL-Impact Intervention in a Nutshell

Ministry of Education in El Salvador plans to ...

- ...expand school time
- ...provide a computer for every child

NGO Consciente picks up the thread and plans to ...

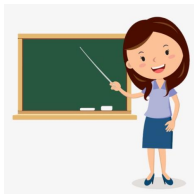
- ...offer additional and computer-based math lessons
- ...investigate the impact of project scientifically

University of Bern becomes partner of Consciente and ...

- ...designs a RCT-study
- ...evaluates the project

CAL-Impact Intervention in a Nutshell

Treatment 1



2 x 90min / Week

~800 Students

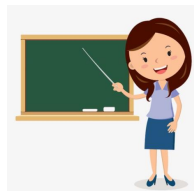
Treatment 2



2 x 90min / Week

~800 Students

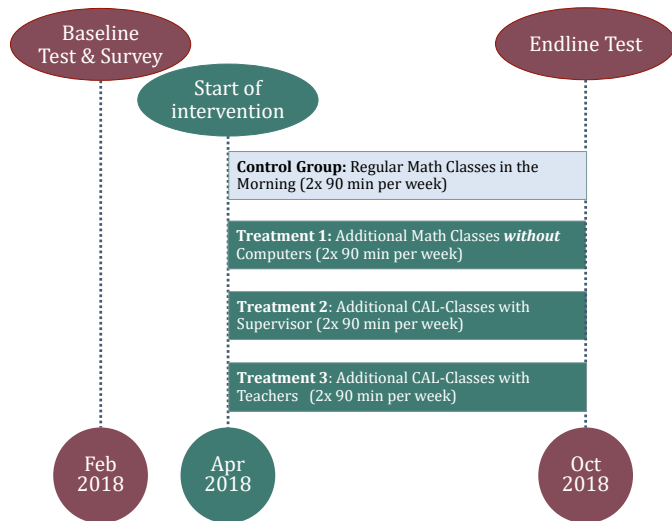
Treatment 3



2 x 90min / Week

~800 Students

Timeline



Study Design

Context



Figure: Map of El Salvador (red: San Salvador, grey: Morazán)

Study Design

Preselection and Randomization

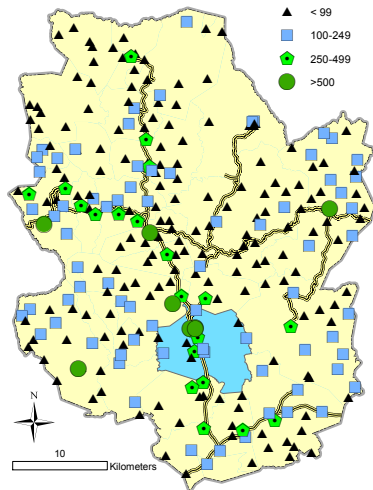


Figure: All schools of Morazán

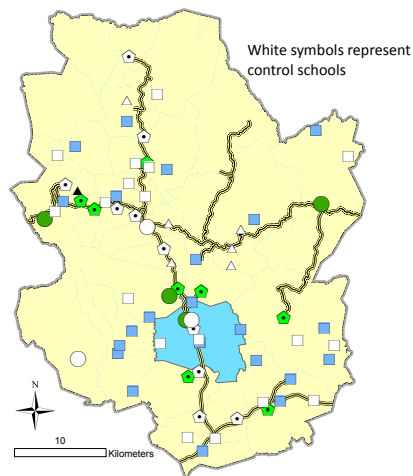


Figure: Preselection of schools in Morazán

Study Design

Estimation Equation

$$MS_{ics}^{Oct} = \alpha + \beta_1 T1_{ics} + \beta_2 T2_{ics} + \beta_3 T3_{ics} + \delta MS_{ics}^{Feb} + \gamma X_{ics}^{Feb} + \lambda_S + \mu_{Strata} + \epsilon_{ics}$$

- 1 Do additional CAL-lessons have a causal impact on numeracy skills?

β_3 : Increase in learning outcomes attributable to CAL-lessons conducted by a teacher

- 2 What is the main causal channel?

$\beta_3 - \beta_1 \geq 0$?: Can the increase in learning outcomes be attributed to the additional lessons and/or the use of software?

- 3 How can CAL-lessons be implemented cost-effectively?

$\frac{\beta_3}{\beta_2} \geq \frac{cost(T3)}{cost(T2)}$?: Are software and teaching skills (strongly) complementary?

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Next steps

- Digitizing endline test ($\frac{1}{3}$ done)
- Evaluation of the intervention and final results
 - Effect on math skills
 - Effect on attendance