Closing Literacy Gaps: A Personalized Technology-Aided Intervention

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Motivation

- Poor literacy skills lead to substantial economic losses in adulthood and employment disadvantages in the labour market [Vignoles, 2016].
- Despite an 18% increase in government spending on schooling over the past decade, many students in OECD countries still finish compulsory education without basic literacy skills [OECD, 2023].
- **Productivity decline**: mismatch between standard classroom instruction and individual learning levels [Muralidharan et al., 2019].
- Contemporary literacy interventions may be effective but are often expensive to implement at scale.
- **Promising solution**: Ed-tech tools → solve the mismatch by offering differentiated instructional content that meets individual learning needs at low cost [Escueta et al., 2020].

What This Paper Does

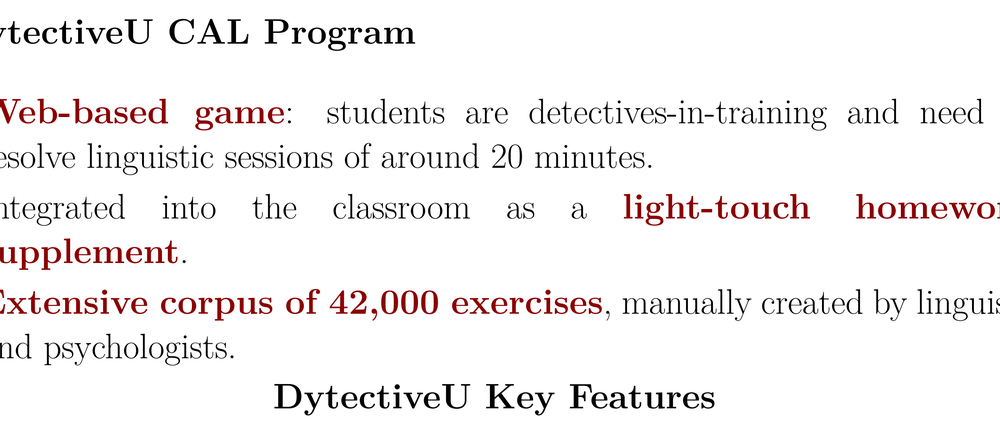
We evaluate a technology-aided intervention that involves the introduction of a CAL program (DytectiveU), designed to close literacy gaps among primary students struggling with reading and writing by offering differentiated instructional content.

DytectiveU CAL Program

- **Web-based game**: students are detectives-in-training and need to resolve linguistic sessions of around 20 minutes.
- Integrated into the classroom as a **light-touch homework supplement**.
- **Extensive corpus of 42,000 exercises**, manually created by linguists and psychologists.

DytectiveU Key Features

1. **Personalized Instructional Material.** DytectiveU receives as inputs: age; completed number of sessions; prior performance.
2. **Dynamically Adaptive Instructional Material.** Exercises target multiple cognitive skills, adjusting content based on user performance relative to age peers.
3. **Immediate Feedback.**



Method

- We leverage the differential timing of the deployment of DytectiveU software across 273 public primary schools in the Region of Madrid (Spain).
- We limited the sample to schools that voluntarily chose to implement DytectiveU, comparing student performance between early and later adopters in the context of non-significant differences at baseline.

Intent-to-Treat Estimates

$$y_{\text{isc}} = \alpha + \beta_1 Treat_s + X_i'\beta_2 + Z_s'\beta_3 + C_c'\beta_4 + \epsilon_{isc} \quad (1)$$

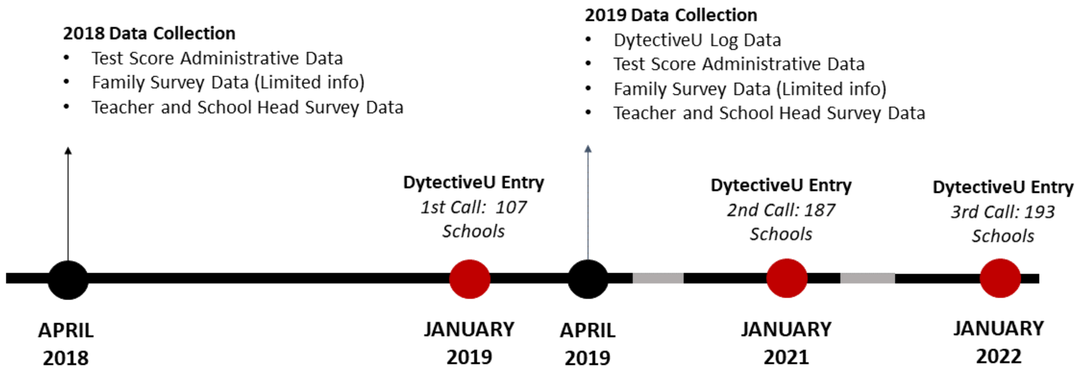
Where y_{isgc} is the standardized score on the 2019 Spanish test of student i, in school s, and class group c. $Treat_{sg}$ is the key regressor and is equal to 1 for treatment schools (i.e., schools implementing DytectiveU in the 2018-2019 call) and 0 for controls schools (i.e., schools implementing DytectiveU in the 2020-2021 and 2021-2022 calls). X_i, Z_s and C_c are vector of personal/family, school and class group characteristics respectively. Standard errors are robust and clustered at school level.

Dose-Response Estimates

$$y_{\text{isgc}} = \alpha + \beta_1 Coverage_{sg} + X_i'\beta_2 + Z_s'\beta_3 + C_c'\beta_4 + \epsilon_{isgc} \quad (2)$$

where $Coverage_{sg}$ is the proportion of students actively using DytectiveU at the school and grade level, which is zero for control schools. All other variables are defined as in Eq.(1).

Data and DytectiveU CAL Program Deployment



Results

- Between **↑ 0.09 sd (ITT Estimates) and ↑ 0.18 sd (Dose Response Estimates)** on the 2019 standardized Spanish language test.
- Driven by low-achieving students (↑ 0.4 sd at the bottom, no gains at the top of the score distribution)
- **Mechanisms:** The results stem from DytectiveU's ability to provide differentiated content, not from improved teaching strategies.

Contributions

1. **Scalability-Cost:** DytectiveU requires minimal supervision, reducing time and resource constraints.
2. **Mechanisms:** Literacy differentiated content to maximize education production function.

References

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