



SYSTEM-, TEACHER-, AND STUDENT-LEVEL INTERVENTIONS FOR IMPROVING PARTICIPATION IN ONLINE LEARNING AT SCALE IN HIGH SCHOOLS

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MOTIVATION

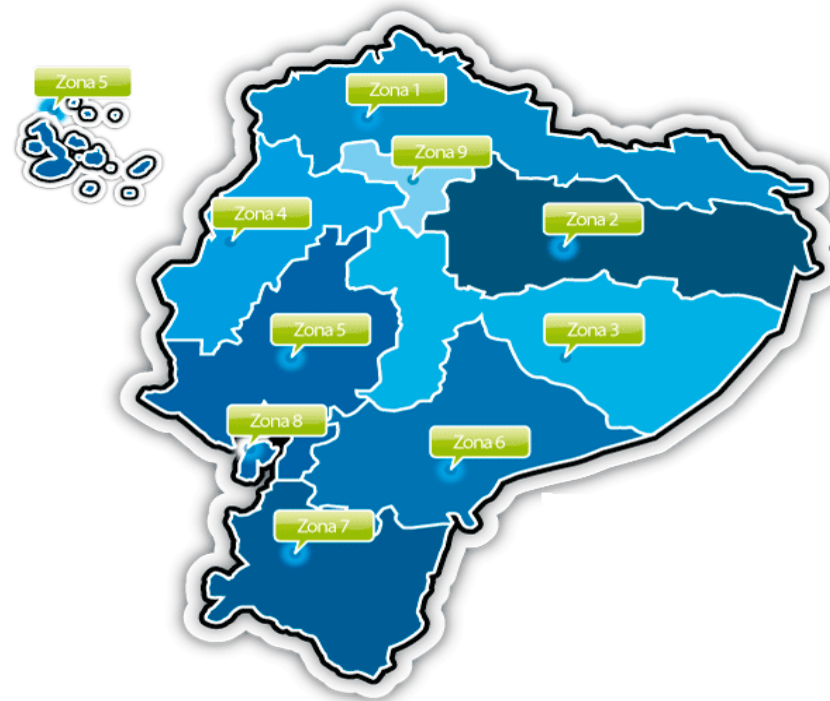
- The COVID-19 pandemic closed schools around the world, affecting more than 1.6 billion students
- More than 90 percent of countries implemented some form of remote learning policy, with digital instruction the most common method of instruction in high-schools
- **Key policy concern: how to ensure sufficient student participation in this online learning?**
- Pre-pandemic context of MOOCs indicates very low completion rates, and then a focus on student-level interventions such as reminders, reward badges, gamification and other behavioral nudges
- But key differences when online learning part of formal compulsory education system:
 - Should expect higher completion rates and greater student incentives to complete the course if part of school
 - Student participation should also depend on actions of **teachers** and through **system-level management** by the Ministry of Education

WHAT DO WE DO?

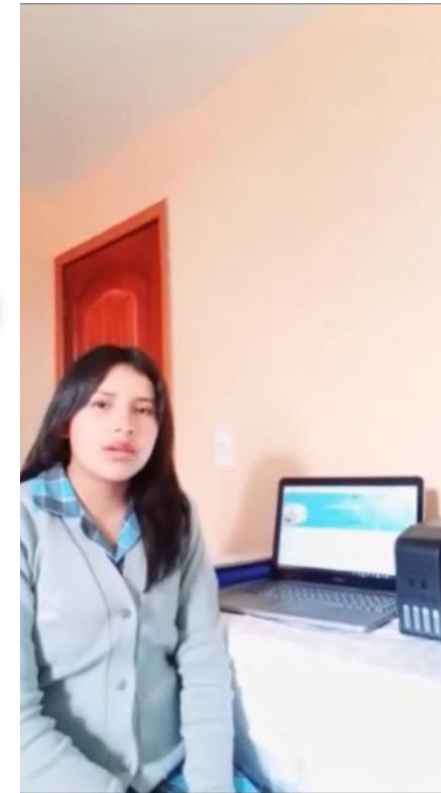
- We conducted experiments with 1,151 schools covering more than 45,000 students in their final years of high school in Ecuador at three levels
 - 1) Student-level,
 - 2) Teacher-level,
 - 3) System-level.

Aiming to improve the online learning process and learning outcomes. Emphasis on **fast to implement and scalable**.

We developed online course modules in entrepreneurial education, statistics and scientific thinking, and Spanish and English language that were designed for students in their final years of high school in Ecuador



Source: educacion.gob.ec



The picture used with kind permission from student, parents, and ministry of education of Ecuador.

STUDENT LEVEL INTERVENTIONS

Financial approach: incentivize learning inputs by providing students with a **lottery ticket** for monetary prizes each time they finish a lesson.

Efforts to help overcome internal constraints:

- **Encouragement messages**
- **Form plans of how they would study**

Team-up remotely with peers for joint accountability



Example of messages on Screen

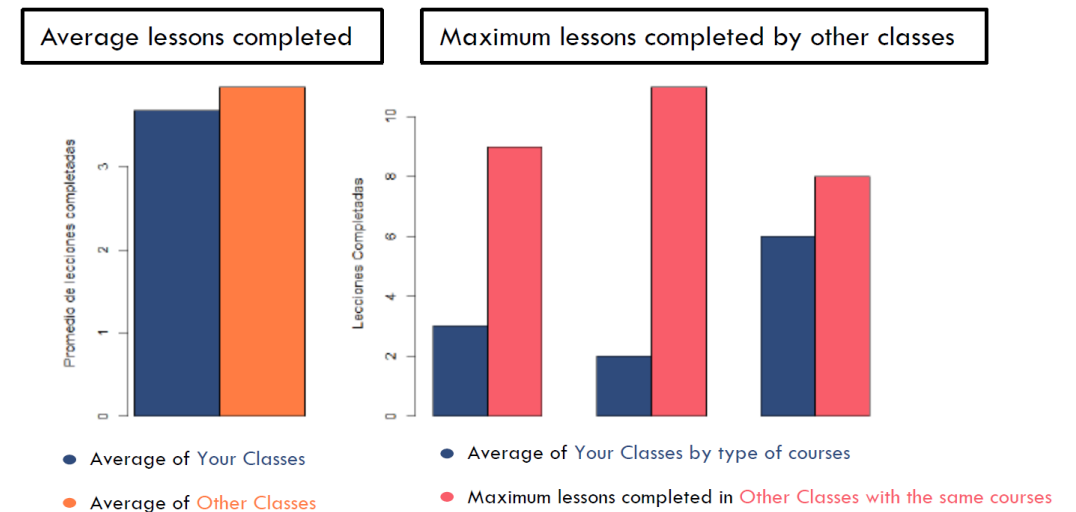
TEACHER LEVEL INTERVENTIONS

Social Comparison Nudge/Benchmarking – weekly email comparing performance of class to those for other classes of the same course type

Reminder nudges – SMS messages to teachers to instruct them to make sure classes finish the content

Encouragement – link to video showcasing experiences of teachers and students who had finished the course in earlier round

Graphical part of Benchmarking letter

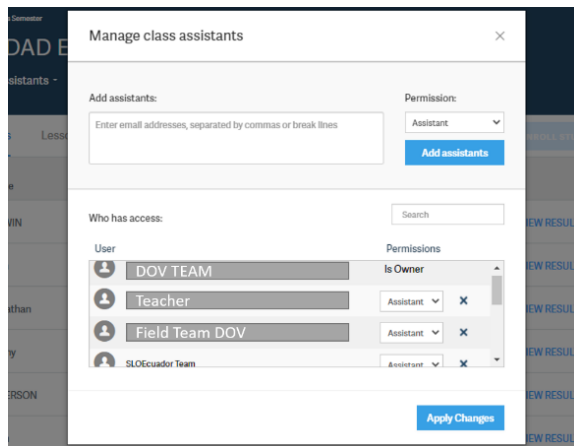


SYSTEM-LEVEL INTERVENTION

Developed a real-time online management system: should delivery of education be decentralized to schools to manage or centrally monitored by Ministry of Education

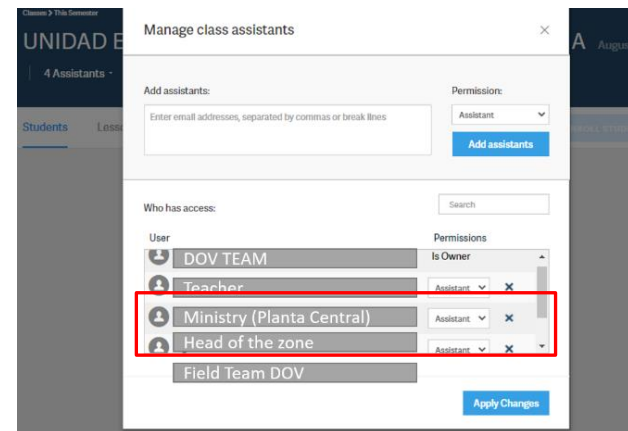
299 schools are randomly allocated to one of the next treatment arms:

a) Self-Management (Control)



b) Centralized Management

- We add ministry personnel to the online management system



- Ministry personnel also get weekly monitoring reports from the system

SYSTEM LEVEL INTERVENTION

If the person is added to the system, she see study progress information like

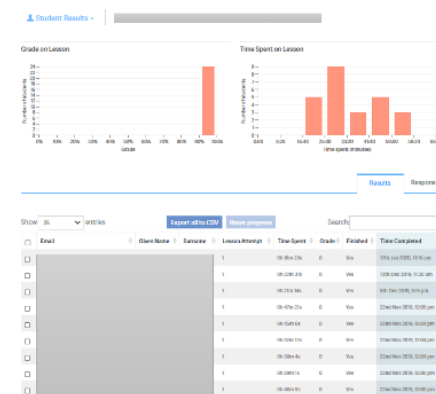
List of enrolled students in class

First Name	Last Name	Email	Status
			Started VIEW RESULTS
			Started VIEW RESULTS
			Started VIEW RESULTS
			Started VIEW RESULTS
			Started VIEW RESULTS
			Started VIEW RESULTS
			Started VIEW RESULTS

List of completed lesson in class

Lesson Title	Start Date	End Date	Status	Completed
Encuesta Inicial	Sep 2019	—	Active	—
Encuesta Inicial1	Sep 2019	—	Active	—
Encuesta Inicial2	Sep 2019	—	Active	—
Gramática del Español				
Módulo 1 ESP: Introducción al español... Nov 2019	—	—	Active	—
Módulo 2 ESP: Elementos verbales... Nov 2019	—	—	Active	—
Módulo 3 ESP: Estrategias cognitiv... Nov 2019	—	—	Active	—

Student Results and progress



Progress per student in class

STUDENT	STARTED	COMPLETED	SCORE
	0	0	N/A
	26	25	TBD
	26	25	TBD
	26	26	TBD
	1	0	N/A
	26	26	TBD
	7	6	TBD

KEY OUTCOMES

We measure impacts on two primary outcomes which measure **how much time students spend on the platform** and **how much they learn**.

Note: status quo not that bad and much higher than typical MOOC

- - average student in control group completes 23.6 out of 27 assigned lessons, spends 1750 minutes or just over 29 hours on the platform. But still room to improve: 55-82% of students complete all modules depending on round/timing.
- Room to improve on learning- median student only getting 22-44% correct on subject knowledge tests

Primary outcomes:

A. Study time index as a z-score based on the following variables that capture take-up: study time on the platform (in minutes), active days on the platform, number of lessons completed.

B. Knowledge index as a z-score based on the performance on five subject-specific knowledge tests executed via the online platform: Statistics and Scientific Thinking, Negotiations, Personal Initiative, English, Spanish.

These indexes are constructed for standardization purposes and to account for multiple hypothesis testing within family of outcomes.

RESULTS: STUDENT-LEVEL INTERVENTIONS I

	Number of Students	Study Time Index	Number of Students	Knowledge Test Index
Student-Level Interventions				
Lottery ticket for lesson completion	11834	0.083*** (0.028)	11680	0.007 (0.024)
p-value		0.003		0.753
q-value		0.019		0.69
Encouragement messages on screen	11834	0.036 (0.028)	11680	0.025 (0.024)
p-value		0.204		0.282
q-value		0.51		0.545
Plan and within household team-up	11834	0.043 (0.031)	11680	0.008 (0.026)
p-value		0.159		0.771
q-value		0.516		0.69
Lottery ticket for lesson completion and score	12422	0.107** (0.053)	10950	-0.064* (0.039)
p-value		0.045		0.1
q-value		0.191		0.191
Team-up with a peer	12422	0.072 (0.047)	10950	-0.04 (0.036)
p-value		0.12		0.271
q-value		0.191		0.191

Note: ITT effects, from regressions that include randomization strata dummies and baseline controls selected by post-double selection lasso. Standard errors in parentheses are clustered at the level of randomization. *, **, and *** denote significance at the 10, 5, and 1 percent levels

RESULTS: STUDENT-LEVEL INTERVENTIONS

Components of increase in study time index

	Dependent variable:		
	Time On The Platform	Active Days	Lessons Completed
	(1)	(2)	(3)
Panel A: Lottery ticket for lesson completion			
Lottery	76.034 (24.925)***	0.094 (0.090)	0.047 (0.096)
Control Group Mean	1418.121	8.225	17.9
Students	11834	11834	11834
Panel B: Lottery ticket for lesson completion and score			
Lottery	91.207 (42.793)**	0.406 (0.287)	0.928 (0.362)**
Control Group Mean	1348.401	8.515	17.9
Schools	448	377	377
Students	12422	12320	12320

The increase in the study time index is primarily driven by time spent on the platform, with an estimated effect of 76 minutes and for the first lottery and 91 minutes more platform time for the second lottery

Note: ITT effects, from regressions that include randomization strata dummies and baseline controls selected by post-double selection lasso. Standard errors in parentheses are clustered at the level of randomization. *, **, and *** denote significance at the 10, 5, and 1 percent levels

RESULTS: TEACHER-LEVEL INTERVENTIONS

	Number of Students	Study Time Index	Number of Students	Knowledge Test Index
Teacher-Level Interventions				
Benchmarking emails	15433	-0.023 (0.071)	12298	0.025 (0.033)
p-value		0.745		0.435
q-value		1		1
Administrative SMS	14398	-0.076* (0.044)	13714	-0.016 (0.042)
p-value		0.088		0.71
q-value		0.544		0.553
Encouragement emails.	14398	-0.038 (0.046)	13714	0.053 (0.039)
p-value		0.405		0.178
q-value		0.553		0.544

Note: ITT effects, from regressions that include randomization strata dummies and baseline controls selected by post-double selection lasso. Standard errors in parentheses are clustered at the level of randomization. *, **, and *** denote significance at the 10, 5, and 1 percent levels

RESULTS: SYSTEM-LEVEL INTERVENTIONS

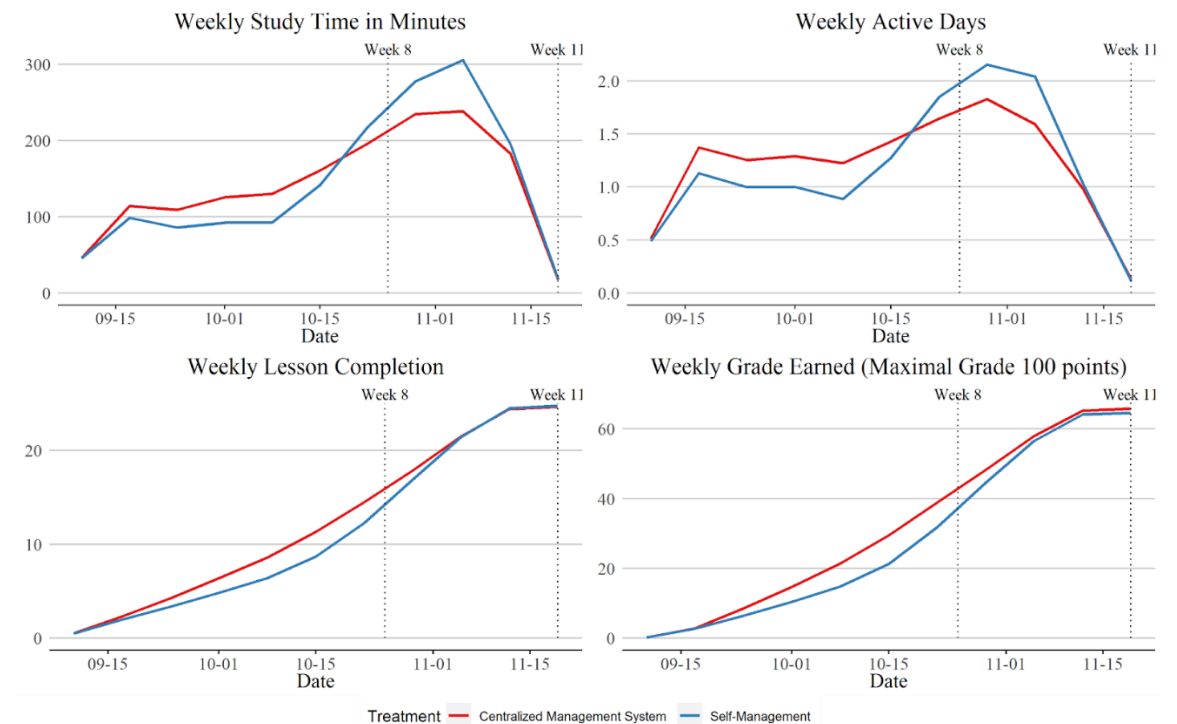
System-Level Intervention	Number of Students	Study Time Index	Number of Students	Knowledge Test Index
Centralized Monitoring: week 8	16547	0.211* (0.114)	8318	0.108** (0.042)
p-value		0.065		0.011
q-value		0.053		0.047
Centralized Monitoring: week 11	16547	0.023 (0.087)	14562	0.126** (0.056)
p-value		0.792		0.025
q-value		0.247		0.047

Note: ITT effects, from regressions that include randomization strata dummies and baseline controls selected by post-double selection lasso. Standard errors in parentheses are clustered at the level of randomization. *, **, and *** denote significance at the 10, 5, and 1 percent levels

- Students in centralized management system score significantly better on a knowledge test in both week 8 and week 11, with a week 11 impact of 0.126 SD (SE 0.056).
- Note that 0.1 S.D. is the median effect size on learning outcomes of large educational interventions in low- and middle-income countries (Evans and Yuan, 2020).

RESULTS: SYSTEM-LEVEL INTERVENTIONS

- The study pattern drastically differs across treatments groups
- Ministry of Education re-exerted its central authority by sending all schools strong messages in week 9 to urge schools to get teachers and students to complete the course.



SUMMARY

- We conducted experiments to improve participation in online learning before, during, and right after the COVID-19 outbreak, with 1,151 schools covering more than 45,000 students in their final years of high school in Ecuador.
- These experiments tested light-touch interventions at scale at three levels: that of the system, teacher, and student.
- A cheap, online learning management system for centralized monitoring increased participation by 0.21S.D. and subject knowledge by 0.13S.D. relative to decentralized management.
- The results show the difficulty in incentivizing online learning at scale, and a key role for central monitoring.