Behavioral Nudges Reduced Dropout Risk among Vulnerable Students during the Pandemic: Experimental Evidence from Brazil[†]

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The COVID-19 pandemic has forced over 1.5 billion children and adolescents across 160 countries to stay at home while schools were shut down on sanitary grounds (Azevedo et al. 2022). A rapidly expanding literature has documented how it led to enormous setbacks in education (e.g., Betthäuser, Bach-Mortensen, and Engzell 2023; Lichand et al. 2022). The International Monetary Fund (2022) forecasted that such losses could cost the current generation of students in low- and middle-income countries up to 10 percent of their future income-generating potential as a result of the "scars" of the pandemic on their accumulated human capital. Nonetheless, such a prediction likely underestimates the educational costs of the pandemic, since it is based on the relationship between test scores and future labor market outcomes holding graduation rates fixed. In truth, recent evidence suggests that in low- and middle-income countries like Brazil—the setting of our study—the pandemic not only led test scores to backtrack but also massively increased dropout risk (Lichand et al. 2022).

While policymakers and international organizations devoted significant attention to interventions that could mitigate learning deficits by the time students would be back in school (e.g., Angrist, Bergman, and Matsheng 2022; Carlana

and La Ferrara 2021), a large fraction of children and adolescents might have left permanently along the way. In contrast, interventions to try to motivate children to stay engaged with school activities during remote learning were largely overlooked.

In a companion paper (Lichand, Christen, and Van Egeraat 2022), we documented that in effect, learning losses in the context of the COVID-19 pandemic were significantly magnified by the fact that most schools neglected students' socio-emotional skills during the transition to remote learning. Taking advantage of a cluster randomized control trial that sent students or their parents text messages targeting their socio-emotional skills during 2020, we showed that such messages were able to prevent 7.5 percent of learning losses in math and 24 percent of those in Portuguese. In this paper, we study whether the intervention also reduced dropout risk, especially among the students at the highest risk of abandoning school.

I. Background and Data

We undertook a cluster randomized control trial in the State of Goiás, Brazil (preregistered as trial 5986 at the AEA RCT Registry), in partnership with Instituto Sonho Grande and the Goiás State Secretariat of Education in the context of their full-time high school program (Ensino Médio em Tempo Integral).

In Goiás, face-to-face classes were suspended in March 2020 and did not resume until mid-2021 (and even then, only where new COVID-19 cases were kept under control). During the school closures, classes switched to online, delivered through a video conferencing and team collaboration platform. Students were assigned daily exercises that they had to hand in through the platform. For those without internet access, schools handed out assignments in

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plastic bags hung at the school front door, and students had to hand them back in the same way.

The intervention, powered by Brazilian EdTech Movva, consisted of sending behavioral nudges twice a week over text messages (SMS) to high school students or their primary caregivers. Whenever there were multiple phone numbers on record for a student, we randomized which would be targeted by the intervention. Content targeted students' socio-emotional skills; in particular, messages tried to motivate students to stay engaged with school activities during remote learning, support them in regulating negative emotions, foster a growth mindset, and develop grit. The intervention was randomized at the school level. In total, 12,056 high school students across 57 public schools received nudges, while another 6,200 high school students across 30 public schools received no nudges or other SMS from their schools. The intervention started on June 9, 2020 (during 2020:II), and continued until July 7, 2021 (at the end of 2021:II). A thorough description of the intervention, along with sample SMS sequences targeting different socio-emotional skills, is provided in Lichand, Christen, and Van Egeraat (2022).

In order to evaluate the impacts of the intervention, we monitored student dropout risk over the course of 2020, based on administrative records shared by the Education Secretariat. Following Lichand et al. (2022), we define high dropout risk as equal to 1 if a student had no attendance on record for both math and Portuguese classes during that school quarter, and 0 otherwise. This and similar measures have also been used in the literature (e.g., Lichand and Doria 2022; Lichand et al. 2022; Sales, Balby, and Cajueiro 2016; Kumar, Singh, and Handa 2017; Lakkaraju et al. 2015) and by the state education secretary and philanthropic organizations that support quality education in Brazil (e.g., to predict which schools are most likely to be affected by student dropouts) (Instituto Sonho Grande 2022).

Estimates of dropout rates among secondary students in Brazil during the pandemic are of the order of 30 percent, relative to 10 percent in 2019 (Lichand and Doria 2022). In our study sample, by 2020:IV, 2.5 percent of students were coded as high dropout risk—about one-third of the figure for the universe of secondary students in São Paulo State at the time, likely because full-time high school students are positively selected. Nevertheless, such dropout risk is associated with a 150 percent increase in expected dropouts relative to the year before the pandemic (see Lichand and Doria 2022 for detailed calculations). Figure A1 in the online Appendix shows that in our sample, dropout risk affected 0–30 percent of students within each classroom by 2020:IV (with ∼40 percent of classrooms featuring at least 1 student at high risk).

We have data on 18,020 students by 2021:IV. We also have data on school characteristics—whether they offered online activities prior to remote learning, and infrastructure conditions such as adequate waste collection, science labs, and computer labs (from the Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira's 2019 school census)—and student baseline characteristics—grade, gender, 2020:I Portuguese and math report card grades, and whether the phone on record belonged to the student him/herself or to their caregiver (from the Secretariat of Education administrative records).

II. Empirical Strategy

We estimate treatment effects by comparing dropout risk across the treatment and control groups by 2020:IV using OLS, clustering standard errors at the school level. Since we cannot verify whether students effectively received messages as intended, all estimates presented are intention-to-treat (ITT) analyses. Table A1 in the online Appendix shows that the treatment and control groups are balanced with respect to all school and student characteristics that we observe.

We further estimate conditional average treatment effects (CATE) by school and student characteristics. To increase precision, we also control for those variables across all specifications. Since our controls include a summary measure of students' baseline report card math and Portuguese grades, in doing so, we drop 70 students (0.4 percent of observations) with dropout risk equal to 1 by 2020:I.

III. Results

Table 1 estimates average treatment effects and CATE by whether schools were below or above median proficiency in the 2019 statewide standardized test scores, by whether students

TABLE 1—TREATMENT EFFECTS ON DROPOUT RISK, AVERAGE, AND CATE

	(1)	Category = below-median school (2)	Category = below-median student- (3)	Category = Girl (4)	Category = previous online activities (5)	Category = Student owns phone (6)
Nudges	−0.001 (0.007)	−0.012 (0.009)	0.004 (0.006)	−0.005 (0.010)	0.017 (0.015)	0.003 (0.008)
Category		−0.005 (0.010)	−0.029 (0.009)	−0.014 (0.005)	0.000 (0.010)	0.009 (0.004)
Nudges × Category		0.011 (0.014)	−0.012 (0.009)	0.007 (0.007)	−0.024 (0.016)	−0.011 (0.005)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,950	13,702	17,950	17,950	17,950	17,950
Clusters	87	58	87	87	87	87
Share of students in category		48%	49%	53%	80%	42%
End-line control mean | Category = 1	0.025	0.025	0.038	0.015	0.023	0.030
p-value(Nudges + Nudges × Category = 0)		0.899	0.472	0.737	0.338	0.333

Notes: All estimates are ITT regressions, estimated through OLS. Across all columns, the dependent variable is dropout risk = 1 for students without math and Portuguese report card grades on record by 2020:IV, and 0 otherwise. Nudges = 1 in schools randomly assigned to the intervention, and 0 otherwise. Column 1 includes the full sample with nonmissing values for the control variables. All other columns estimate heterogeneous treatment effects, by school and student characteristics: column 2, by whether schools that students were enrolled in were below or above median proficiency in the 2019 statewide exam (based on a summary measure of Portuguese and math scores for its high school seniors); column 3, by whether students were below or above median 2020:I report card grades (a summary measure of Portuguese and math); column 4, by whether students were female or male (according to school records); column 5, by whether the schools that students were enrolled in did or did not offer online academic activities prior to the pandemic (according to the 2019 school census); and column 6, by whether the phone number targeted by the intervention belonged to the student him/herself or to a primary caregiver. Column labels display the proportion of observations in that category. End-line control mean (category) = mean dropout risk by 2020:IV for students of that category within the control group. Controls include student gender, grade, and phone ownership; a summary measure of 2020:I Portuguese and math report card grades; and indicators of school-level presence of online activities, adequate waste collection, science labs, and computer labs (according to the 2019 school census). Standard errors clustered at the school level in parentheses.

were below or above median 2020:I average report card grades in our sample, by student gender, by whether schools did or did not offer online activities even before the pandemic (by 2019), and by whether it was the student's phone or their primary caregiver's that was targeted by the text messages.

We find that while the intervention did not decrease dropout risk on average (column 1), treatment effects were highly heterogeneous according to school and student characteristics. Some effect sizes are large, albeit imprecisely estimated. Treatment effects are concentrated on students with below-median baseline achievement (column 3, a ∼22 percent reduction in dropout risk; $p = 0.47$) and entirely driven by schools that offered online activities prior to the pandemic (column 5, for which dropout risk is estimated to have been lowered by ∼30 percent; $p = 0.34$). Targeting seems key: students who received messages directly on their phones saw

a ∼27 percent reduction in dropout risk (column 6; $p = 0.33$), ending up with statistically lower risk than those indirectly targeted (significant at the 10 percent level). In turn, whether the school was above or below median baseline proficiency (column 2) and student gender (column 4) are associated with much smaller effect sizes.

IV. Discussion

Taken together with Lichand, Christen, and Van Egeraat (2022), our results back up the claim that supporting students' socio-emotional skills contributed to mitigating part of the most dramatic effects of remote learning, especially for the most vulnerable students. While socio-emotional skills will likely continue to be important in the aftermath of the pandemic, these tend to be overlooked even outside of the emergency transition to remote learning. To that point, Lichand and Doria (2022) documented

that SMS communication with students to promote a growth mindset (beliefs that intelligence is malleable) boosted learning recovery among secondary students in São Paulo as in-person classes resumed above anything else, but it was only adopted by less than 10 percent of municipalities in the state.

At the same time, there are limits to how much that socio-emotional support can achieve on its own. Our results show that the largest effects of the intervention were concentrated in schools that already featured online academic activities prior to the pandemic. Effective remote learning activities might be necessary—even if clearly insufficient—to keep all students engaged and motivated to return to in-person classes.

Last, while targeting primary caregivers effectively shielded learning losses during the pandemic (Lichand, Christen, and Van Egeraat 2022), our results show that when it comes to dropout risk, it might be crucial to reach out to students directly. Incidentally, this result helps us rule out that the intervention worked merely because school staff knew that students were being nudged in treated schools. Within each school assigned to treatment, teachers and school principals did not know whether each student was targeted directly or indirectly (via their caregivers' phone) by the intervention.

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