Impacts of PBL Training on Teachers' Beliefs: Evidence from Brazil

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PRELIMINARY DRAFT

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Abstract

Using data from an RCT carried out in Brazil between 2019 and 2020, we investigated the impacts of teachers' training in active learning methodologies, notably Project-Based Learning, on the beliefs and attitudes of upper-secondary Math teachers. The program was implemented with the goal of making the concepts taught more attractive to young people and of including financial education concepts in the regular curriculum of Brazilian schools. Our findings suggest that the program made teachers more optimistic about their students' future and more experienced with remote teaching during the school closures of the COVID-19 pandemic. Treated teachers also seem to have assimilated financial education notions into their own lives, reporting lower debt than the control group. On the other hand, when evaluating relevant socio-emotional skills, we found that they presented lower self-efficacy and perseverance by the end of the intervention.

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1 Introduction

The literature on economics of education has highlighted the pivotal importance of teachers in determining students' short and long-term academic performance. In a seminal work and using a large panel dataset, Rivkin et al. (2005) disentangle the impact of schools and teachers on students' achievement, finding that educators have considerable effects on reading and math attainment. Chetty et al. (2014) show that students assigned to teachers with high added-value, measured as the short-term effects on pupils' school performance, are more likely to attend college, earn high salaries, and less likely to experience teenage pregnancy. There is also evidence in this line for low and middle-income countries (Bau and Das, 2020; Buhl-Wiggers et al., 2017).

The aforementioned studies, however, also point out that little of the variation in teacher quality is explained by straight observed characteristics, such as education and professional experience. In fact, many recent works have uncovered the role played by teachers' beliefs in their teaching performance. Wolf and Brown (2023) provide a broad review of the theme. While a growing body of literature on the role of beliefs provides insights about the main ones behind teachers' motivation and, ultimately, value-added, research on potential programs to impact these beliefs is still not as extensive.

This paper seeks to understand whether teacher training in active learning methodologies, notably Project-Based Learning (PBL), can affect teachers' perception of students' academic perspectives and the role they play in student achievement, with a focus on disadvantaged teenagers from Brazilian public schools. For this, we use primary data from a randomized controlled trial (RCT) carried out in Brazil in the second half of 2019 and the first year of the COVID-19 pandemic, therefore mixing in-person and remote experiences.

The program evaluated is a bundle of interventions that aimed to assess the possibility of including financial education in the regular mathematics curriculum, intending to make it more attractive for students and, thus, increasing their engagement and affecting their learning. In its in-person version, the program provided didactic materials to students and PBL training for teachers so that they could teach the classes more interactively with students, working to develop not only mathematical concepts but also financial education and carry out learning exchanges aimed at creating plans for the future.

Some of our findings are fairly encouraging. Teachers who were assigned to receive two semesters of the PBL training, in addition to a semester of financial education classes, were more optimistic by the end

of the intervention about the likelihood of their 9th-grade students finishing high school, even in a period of increased uncertainty and lower student engagement due to the hit of the pandemic and the school closures in 2020. This result is quite relevant as the literature has increasingly shown the importance of teachers' beliefs about their students' potential in shaping teenagers' views about their own academic and professional path (Rosenthal and Jacobson, 1968), particularly among relatively disadvantaged students who do not have many adult references with higher education outside of school (or even with high school in the Brazilian context) (Burgess and Greaves, 2013; Dee, 2015).

Teachers in the treatment group also felt more experienced with remote teaching by the end of the first semester of school closures than their peers in the control group. We observe, although, an adverse effect of the program on some relevant socio-emotional skills. Treated teachers became more critical about their performance and ability to convey the content to students despite their more optimistic perspective on students' future. We also know from the literature that teachers' perception that they can help disadvantaged students is a predictor of their effectiveness (Filmer et al., 2021). The results, taken altogether, make our findings mixed about the potential of the PBL on positively impacting teachers' beliefs. This can be related to the moment the experiment was implemented and demands further investigation about the mechanisms behind it.

Our work also contributes to the financial education literature, as it finds results suggesting that including financial education in the regular school curriculum might also positively affect teachers' financial awareness, a finding that corroborates some emerging evidence in this line as provided by Frisancho (2023).

Besides this introduction, the paper presents a literature review in the next section and the Brazilian educational context (*to be developed*). The intervention outline, randomization, and empirical strategy are presented in the third section. Section four presents a description of the survey instruments used (*to be developed*), the summary statistics, and an attrition and take-up assessment (*to be developed*). The fifth section brings the results, while the last one concludes and discusses future avenues of research.

2 Research Design

2.1 Intervention Outline

In 2019, in partnership with the BEI Institute, a specialized financial education organization, the Secretary of Education of Goiás (Brazil) implemented the pilot version of the program "Learning to Deal with

Money". The intervention's ultimate goal was to include financial education in the regular mathematics curriculum to make the concepts studied more applied, encouraging students' interest and engagement in math classes, as well as enhancing their financial education.

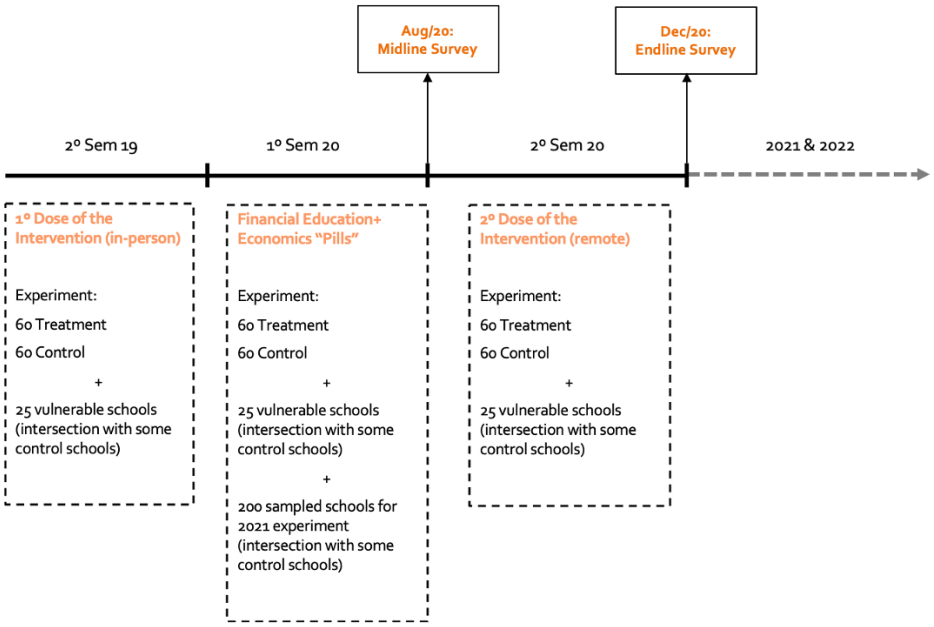
The program was designed as a bundle of interventions. First, it provided 9th-grade students and teachers with pedagogical materials: a student textbook and a teacher's pedagogical guide. The former offered practical financial education by working on students' math skills through everyday problems in simple contexts and exercises. The teacher's pedagogical guide provided a step-by-step method for developing and implementing the Project-Based Learning (PBL) methodology within a class, with tools designed to engage students in creating collective projects. Second, teachers were provided with in-service training on active learning methodologies.

This twofold design was implemented as a pilot version in the second semester of 2019 and in an improved version with more students during 2021 and 2022, with the re-opening of public schools in Goiás after the first year of the COVID-19 pandemic. The initial plan was to implement the program with teachers and students in person in 2020 after an evaluation of the pilot. However, due to the uncertainty brought by the outbreak of the coronavirus pandemic, this implementation was postponed to the following year. Still, seeking to support public schools that were facing difficulties with the discontinuity of in-person activities, with overloaded teachers struggling even more to motivate students and with more severe effects on low-income students, the Secretary of Education and the BEI Institute chose to provide additional training to teachers at the participant schools of the pilot program.

Therefore, teachers who were in treated schools in 2019 and remained there in the following year received three semesters of training: initially, they participated in workshops in Project-Based Learning methodologies with a focus on teaching mathematics; then in the first half of 2020, they were provided with access to short-term e-learning courses in financial education and economics ("knowledge pills"); whereas in the second half of that year, a second dose of the PBL training with a focus on math and financial education was delivered remotely through the Secretary of Education system. The figure below summarizes this timeline, also providing information about the number of schools involved in the evaluation and the data collection carried out.

The program was conceived to be implemented through an experimental design in its pilot version as well as in the following biennial, which would allow a rigorous evaluation of its impacts on students and teachers. Thus, the initial sample of 120 schools selected by the Secretary of Education of Goiás to

Figure 1: Study Timeline



Elaborated by the authors.

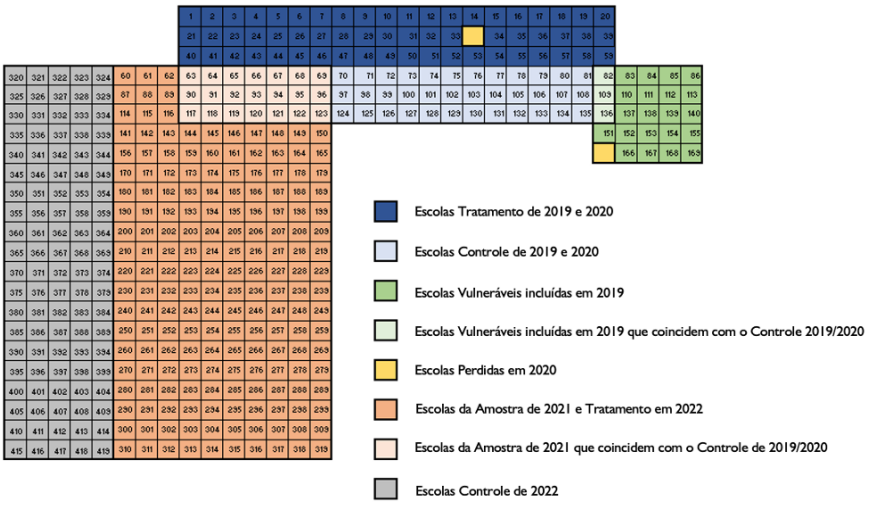
participate in the pilot evaluation was divided by a draw into a treatment and a control group, each with 60 schools. After the draw, however, the Secretary requested the BEI Institute to include 25 vulnerable schools of the State Educational System in the group foreseen to receive the program. Among them, there were three from the control group and, therefore, those are no longer considered in the experimental evaluation.

In fact, considering the entire period of analysis, the control group suffered other losses, which resulted from the Institute's decision to make available to teachers from schools treated in the pilot evaluation, as well as from the 200 schools sampled to compose the larger evaluation planned at the time for the following biennium (later postponed to 2021-22 due to the restrictions imposed by the coronavirus pandemic), access to the "knowledge pills" in financial education and economics in the first half of 2020. Among the schools sampled for the larger assessment, there were 21 previously allocated to the control group. Therefore, these are no longer considered as "pure" controls in our experimental evaluation. The figure below provides a schematic to illustrate the mentioned sample intersections.

One can see that considering the intersections imposed by the policy decision of the Secretary to provide the program to highly vulnerable schools, as well as by the efforts to respond to the shock caused

by the pandemic, the experimental sample is composed of 59 treated schools and 35 in the "pure control" group. This is the focus of our paper, although we plan to explore the results of these 21 schools that received the "knowledge pills" to dive into the mechanisms behind the effects of the intervention - for instance, to understand whether the effects on financial literacy and awareness come from the PBL training on applied math and financial education or from the e-learning pills. The results from the intervention are discussed in more details in Section 4.

Figure 2: Sample Intersections (*To be translated*)



Elaborated by the authors.

As can be seen in the timeline, two data collections were carried out within the scope of the experimental evaluation: a midline in August 2020, at the beginning of the resumption of the second academic semester and after the distribution of financial education pills; and an endline collection in December 2020, at the end of the second dose of the PBL training. Remote surveys were applied to teachers from schools included in the previous semester's training (the August collection included the 200 schools sampled for the following year's evaluation). It is worth noting that although best practices recommend carrying out a baseline survey in experimental evaluations, it was not possible in the present study. This is due to the need to reduce costs in the face that, when planning the pilot evaluation in 2019, a large-scale experiment was foreseen for the following year, with in-person baseline and endline surveys with students and teachers.

2.2 Sample Selection and Randomization

As briefly presented above, the schools participating in this experimental evaluation were chosen by the Secretary of Education of Goiás in the first half of 2019. The selected schools are from various regional administrations of the state educational system and offer both elementary and high school education, as the program was designed to be initially implemented on the 9th grade and later be expanded to the first year of high school (10th grade in Brazil). Additionally, it should be noted that these schools did not have a military, technical or full-time curriculum during the timeline of the intervention.

With the aim of mitigating the risk of imbalances in important dimensions between treatment and control groups, the 120 schools were paired according to relevant characteristics before the draw. For this, we used their proximity in terms of a factor, computed by principal component analysis, that summarizes the following features: the number of students in the school, the average math score in the state standardized exam (SAEGO), and general performance in the national education assessment (IDEB, Index of Elementary Education Development). Then, within each pair, one school was drawn to receive the program, while the other was allocated to the control group.

As presented in the previous subsection, due to the decision of the Secretary of Education to provide the program to 25 selected vulnerable schools in the state, 3 of them from the randomly assigned control group, and the choice of the BEI Institute to provide access to the e-learning courses to all teachers of the schools sampled for the experimental evaluation postponed to 2021 (which included 21 control schools), our experimental sample was considerably reduced. This scenario imposed some challenges for the evaluation of the program's impacts, due to the loss of power. As it will be discussed in the next subsection, we adopted some strategies to overcome these issues.

2.3 Empirical Strategy

We use an intention-to-treat (ITT) analysis to evaluate the impact of the program on the different dimensions, as measured by the difference in means between the treatment and control groups, according to the following OLS regression:

$$y^f_{isp} = \alpha + \beta \cdot Treatment_s + \mathbf{X}'_i \cdot \boldsymbol{\delta} + \epsilon_{isp}$$

Here, y^f_{isp} denotes the outcome of interest of teacher i in school s of matched-pair p in the survey f

(midline of Aug/2020, or endline of Dec/2020). The impact of the treatment is given by β, the coefficient associated with the dummy variable $Treatment_s$. This variable indicates school-level random treatment assignment within each matched-pair p, which takes value one when school s is in the treatment group and zero otherwise. The specification also includes a vector of individual-level characteristics, $\mathbf{X}_i$. Those are generally time-invariant features[1], such as race, gender, educational background, and a wealth index, which were measured at the midline survey due to the aforementioned absence of a baseline collection.

As discussed in the previous subsections, due to the efforts of the Goiás Secretary of Education and the BEI Institute to provide some e-learning materials to other schools in the system in the most critical months after the outbreak of the COVID-19 pandemic, the experimental control group suffered losses, creating difficulties in using the initial matched-pairs design. If we chose to follow the suggestion of Bruhn and McKenzie (2009) and drop all pairs with an attrited or lost unit (26 pairs), we would significantly lose statistical power, as around half of our sample would be lost.

It is also worth mentioning that as Glennerster and Takavarasha (2014) claim in their work, dropping pairs may increase the attrition bias, and the widespread practice of including pair fixed effects in the regression is equivalent to computing the difference-in-means estimator after the pairs drop. In this sense, we opted not to include these fixed effects in our regression to avoid losing power and following the recent findings and suggestions from Bai et al. (2024). The authors show that dropping pairs does not seem to solve attrition issues and may not recover the average treatment effect if the attrition is a function of the matching variables. Still, for robustness purposes, we also run the regressions including matched-pair fixed effects, as well as using the approach adopted by Bruhn et al. (2016), that include a common dummy for all the schools that would have been dropped due to the non-compliance of their pairs. We present these results in the Appendix and briefly discuss them along with the main findings.

Among the main findings, we also test two specifications for robustness checks: one including only a dummy for race in the vector $\mathbf{X}_i$, and a second with other relevant time-invariant characteristics. The first model is due to the imbalance in this characteristic between the treatment and control groups, as it is presented in the next section [2]. The second specification is a robustness check including all the generally

[1] And likely not to be affected by the intervention.

[2] Despite the robustness of random assignment in the experimental design, baseline imbalances between treatment and control groups can still occur purely by chance. This is because randomization guarantees equality on average across many trials, but not necessarily within each individual trial. When several covariates are involved, these imbalances may become statistically significant at conventional significance levels. For example, assume that we had 100 different variables to test for differences between control and treatment groups. At a 10% significance level, one could expect that at most 10 of them would show an imbalance by chance alone.

time-invariant variables surveyed in the midline collection.

For outcomes that are part of a family of items, such as individual questions from a set or facets of aggregate outcomes, the Romano-Wolf correction is implemented, aiming to correct for the familywise error rate (FWER) when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). It is worth highlighting that our results are quite conservative as we opted to cluster the standard errors at the school-pair level, following the recent findings from De Chaisemartin and Ramirez-Cuellar (2024), instead of adopting the widespread practice of using the randomization unit (in this case schools). In addition, as presented by the authors, even in the case that pairs fixed effects are not used, the pair-clustered variance estimator seems to produce more robust results.

3 Data and Measurement

3.1 Survey Instruments

To be Developed: Description of the surveys Aug/20 and Dec/20

3.2 Summary Statistics

As we do not have baseline data for teachers, we use generally time-invariant variables collected in the midline survey to assess pre-treatment balance across groups. Notably, we evaluate the proportion of teachers in each group who: are male; white; have a bachelor's degree in mathematics (with a teaching track); graduated more than a year ago; have a master's and/or a doctorate's degree; and who live in their own home (do not rent or live out of favor).

We check the balance across these dimensions and their joint significance using the experimental sample discussed in the previous section — the randomly assigned treatment schools and the control units that did not receive any type of intervention during the one-and-a-half years assessed in this paper. As can be seen, the proportion of white teachers in the treatment group is significantly higher than in the control. Indeed, despite the robustness of the random assignment, baseline imbalances can still occur in experimental designs purely by chance. Hence, we include the imbalanced variable in the specification, as well as the whole set of controls to check the robustness of our results and due to the significance of the joint test [3].

[3]Note that when considering the matched-pair fixed effects, as it is a common practice, there is no imbalance across the groups

Table 1: Balance in Time-Invariant Variables

	Control	Treatment	Diff. (T-C)	p-value	Obs.
Male	0.56	0.48	-0.07	0.44	102
White	0.22	0.42	0.20**	0.02	102
Bachelor's Degree in Math	0.83	0.70	-0.14	0.11	102
Graduated more than a year	0.97	0.95	-0.02	0.65	102
Graduate Degree	0.14	0.14	0.00	0.97	102
Owns a House	0.67	0.79	0.12	0.13	102

Note: The table presents the groups' means, the difference between them, and the respective p-values. Significance levels (*10%; **5%; ***1%) are captured through OLS estimation accounting for clustered standard errors (by school pair). F-test of joint significance: 3.932***. Note that we use the dimensions as measured by the midline survey, due to the absence of a baseline survey, and considering the endline sample.

3.3 Implementation, Take-up, and Attrition

To be Developed: Implementation guidelines, teachers' attendance on training, and attrition tables.

We do not find evidence of differential attrition, considering the experimental sample of schools and the teachers assigned to the pilot experiment in 2019.

4 Results

4.1 Expectations about Students' Future

One of the most promising results is the positive impact of the program on teachers' expectations regarding their students' future. Teachers who were assigned to receive two semesters of the PBL training, in addition to the financial education e-learning courses in the first semester of 2020, are more optimistic by the end of that year about the possibility of their 9th-grade students finishing high school, even in a period of increased uncertainty and lower student engagement due to the COVID-19 pandemic and school closures. The effect is statistically significant even after the Romano Wolf familywise error rate correction.

The positive impact is only noticeable at the end of the second PBL training and is not detectable at the midline, despite the positive point estimate. This may be related to the fact that, at that time, the treated teachers had received the active learning methodologies intervention more than a semester ago and had faced adverse months immediately after the pandemic outbreak. Furthermore, no effect is detected on

and no joint-significance.

long-term expectations, such as entering university and completing higher education.

These results are still encouraging, as the literature on the economics of education has increasingly shown the importance of teachers' beliefs about students' potential for their teaching performance and in shaping teenagers' own beliefs about their academic and professional prospects (Rosenthal and Jacobson, 1968), particularly among disadvantaged students who do not have many adult references with higher education outside of school (or even with high school in Brazil) (Burgess and Greaves, 2013; Dee, 2015).

Figure 3: Expectations about students' future - Aug/20

	Conclude 9th Grade	Conclude High School	Enter University	Conclude Undergraduate
Treatment	-0.0101	0.103	-0.00600	-0.00600
	(0.0104)	(0.0690)	(0.0866)	(0.0892)
Original p-value	0.34	0.14	0.95	0.95
RW p-value	0.32	0.14	1.00	1.00
School Pair FE	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes
Observations	111	111	111	111
R-squared	0.019	0.030	0.000	0.000

Note: This table presents OLS regression results for the impact of the program on the expectations of teachers about their students' future (dummies capturing whether they believe the majority of their students will achieve each academic stage mentioned). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

Figure 4: Expectations about students' future - Dec/20

	Conclude 9th Grade	Conclude High School	Enter University	Conclude Undergraduate
Treatment	0.0515	0.142*	-0.00723	-0.0791
	(0.0346)	(0.0790)	(0.0955)	(0.0943)
Original p-value	0.14	0.08	0.94	0.41
RW p-value	0.18	0.08	0.89	0.52
School Pair FE	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes
Observations	102	102	102	102
R-squared	0.041	0.061	0.005	0.009

Note: This table presents OLS regression results for the impact of the program on the expectations of teachers about their students' future (dummies capturing whether they believe the majority of their students will achieve each academic stage mentioned). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

4.2 Socio-emotional Skills and Experience with Remote Teaching

Recent works in the economics of education have shown that teachers' beliefs are important predictors of their effectiveness in teaching (Filmer et al., 2021). Among these relevant beliefs is the perception that they can help disadvantaged and struggling students learn. In fact, Filmer et al. (2021) show evidence that supports this finding for math teachers.

In this sense, we evaluate the impacts of the intervention on teachers' related socio-emotional skills, which are also seen by the literature as playing a relevant role in determining academic and professional outcomes (Heckman et al., 2006; Duckworth et al., 2007), namely: grit, internal locus of control and self-efficacy.

Similar to the findings on teachers' beliefs about their students' future, the socio-emotional skills did not show any significant difference between the groups at the midline collection. However, the endline survey revealed unexpected adverse effects on both grit and self-efficacy measures. This suggests that treated teachers became more critical of their performance and ability to convey the content to students despite their more optimistic perspective about their academic future. They also showed less perseverance, with both impacts being around 35% of the standard deviation of the control group.

Although we cannot properly disentangle the mechanisms behind this finding, our understanding, considering the whole set of results, is that teachers became more aware of the difficulties imposed by the

pandemic on the development of the best pedagogical practices, notably those being worked on the PBL training.

Figure 5: Socio-emotional Skills - Aug/20

	Grit	Self-Efficacy	Internal LoC	Internal LoC (on students difficulties)
Treatment	-0.105	-0.395	-0.331	-0.00670
	(0.200)	(0.245)	(0.234)	(0.172)
School Pair FE	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes
Observations	108	110	110	111
R-squared	0.003	0.025	0.022	0.002

Note: This table displays OLS regression results for the impact of the program on teachers' socio-emotional skills. The skills outcomes are indexes standardized using the mean and standard deviation of the control group to facilitate interpretation and enhance comparability with other studies. Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

Figure 6: Socio-emotional Skills - Dec/20

	Grit	Self-Efficacy	Internal LoC	Internal LoC (on students difficulties)
Treatment	-0.350*	-0.383**	-0.110	-0.284
	(0.201)	(0.157)	(0.218)	(0.226)
School Pair FE	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes
Observations	102	102	102	102
R-squared	0.032	0.038	0.008	0.024

Note: This table displays OLS regression results for the impact of the program on teachers' socio-emotional skills. The skills outcomes are indexes standardized using the mean and standard deviation of the control group to facilitate interpretation and enhance comparability with other studies. Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

Another dimension evaluated was teachers' experience with the remote classes during 2020, the first year of the COVID-19 pandemic, during which the schools remained entirely closed in Brazil. We found that at the midline, teachers in the treatment group felt they were more experienced with remote teaching than in the first week of school closure (mid-March 2020), around 0.15 SD (standard deviation) higher than the control group. This result is also robust to the Romano-Wolf correction but disappears by the end of the school year. Teachers then became more pessimistic about their ability to teach remotely, which aligns with the aforementioned self-efficacy results.

Figure 7: Experience with Remote Teaching - Aug/20

	More confortable to the format	How experienced teachers felt	Index
Treatment	-0.0429	0.150**	0.114
	(0.215)	(0.0567)	(0.235)
Original p-value	0.84	0.01	-
RW p-value	0.77	0.01	-
School Pair FE	No	No	No
Unbalanced Variable	Yes	Yes	Yes
Observations	106	106	106
R-squared	0.008	0.044	0.016

Note: This table presents OLS regression results for the impact of the program on the perceptions of teachers about the remote learning during the semester in comparison to the first week of remote classes immediately after the school closures (dummies capturing whether they feel more comfortable or more experienced about the format). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). The index summarizes both results and is standardized using the mean and standard deviation of the control group to facilitate interpretation and enhance comparability with other studies. Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

Figure 8: Experience with Remote Teaching - Dec/20

	More confortable to the format	How experienced the teachers felt	Index
Treatment	-0.0701	-0.0194	-0.0632
	(0.191)	(0.110)	(0.166)
Original p-value	0.72	0.86	-
RW p-value	0.87	0.87	-
School Pair FE	No	No	No
Unbalanced Variable	Yes	Yes	Yes
Observations	102	102	102
R-squared	0.001	0.001	0.001

Note: This table presents OLS regression results for the impact of the program on the perceptions of teachers about the remote learning during the semester in comparison to the first week of remote classes immediately after the school closures (dummies capturing whether they feel more comfortable or more experienced about the format). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). The index summarizes both results and is standardized using the mean and standard deviation of the control group to facilitate interpretation and enhance comparability with other studies. Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

4.3 Financial Literacy and Awareness

As presented in section 2, the pedagogical training for teachers is part of a broader program to include financial education in the regular school mathematics curriculum, making it more attractive to young people with direct applications in everyday life, while developing financial literacy and awareness. Thus, teachers in the schools assigned for treatment had contact with financial education concepts indirectly for two semesters through pedagogical training in PBL, which made use of the materials and content proposed to the students, and directly for one semester through access to remote short courses in financial education and economics (self-administered).

In this sense, evaluating the effects on teachers' knowledge and financial awareness is highly relevant, considering the general difficulty of involving adults in financial education programs (Bruhn et al., 2014) and the high indebtedness of Brazilian families. When we look at teachers' financial situation, as self-reported in the midline and endline surveys, the program seems to have a significant impact, decreasing the likelihood of individuals being late in payments and having a negative bank balance. Notably, the effect on the probability of being late in payments is robust to the Romano-Wolf correction and it lasts for months after the direct financial education course, which occurred before the midline survey.

As our measures are based on self-report, this result may suffer from bias. However, since the decrease in payment delays is maintained even after the direct treatment in financial education (still reported in the endline), it signals a real effect on teachers' financial situation. Furthermore, although it is only self-reported, it indicates an improvement in the respondents' awareness of the best practices.

We evaluate teachers' financial literacy, as assessed by stylized questions from the specialized literature (Lusardi and Mitchell, 2011) on: simple interest rate, compound interest, inflation, and risk diversification. We found no statistically significant effects on the four dimensions analyzed or overall performance. We observe positive point estimates shortly after the financial education e-learning courses in the standardized overall performance rate and in the likelihood of correct answers in the four questions. However, these results are not statistically significant, which may be related to the loss of statistical power in the process. These diminish at the school year's end, again suggesting the training's short-term effects.

Figure 9: Financial Situation (self-report) - Aug/20

	Had Negative Balance or Used Overdraft	Took a payroll loan or paid an installment of payroll loan	Took a personal loan or paid an installment of personal loan	More than 2 months behind on bill payments	More than 2 months behind with your financing payments
Treatment	-0.193*	-0.0569	-0.0306	-0.157**	-0.0739
	(0.104)	(0.0905)	(0.0728)	(0.0666)	(0.0642)
Original p-value	0.07	0.53	0.68	0.02	0.25
RW p-value	0.13	0.67	0.67	0.03	0.44
School Pair FE	No	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes	Yes
Observations	105	105	105	105	105
R-squared	0.044	0.007	0.001	0.077	0.012

Note: This table presents OLS regression results for the impact of the program on the self-report financial situations experienced by the teachers (dummies capturing whether they were facing or not the mentioned situations). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

Figure 10: Financial Situation (self-report) - Dec/20

	Had Negative Balance or Used Overdraft	Took a payroll loan or paid an installment of payroll loan	Took a personal loan or paid an installment of personal loan	More than 2 months behind on bill payments	More than 2 months behind with your financing payments
Treatment	-0.0439	-0.0732	-0.112	-0.122*	-0.099
	(0.0922)	(0.105)	(0.116)	(0.0721)	(0.0657)
Original p-value	0.64	0.49	0.34	0.10	0.14
RW p-value	0.58	0.58	0.41	0.20	0.23
School Pair FE	No	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes	Yes
Observations	102	102	102	102	102
R-squared	0.011	0.007	0.017	0.031	0.030

Note: This table presents OLS regression results for the impact of the program on the self-report financial situations experienced by the teachers (dummies capturing whether they were facing or not the mentioned situations). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

Figure 11: Financial Literacy - Aug/20

	Simple Interest	Compound Interest	Inflation	Risk Diversification	Average Score
Treatment	0.0967	0.104	0.0407	0.0587	0.331
	(0.0816)	(0.113)	(0.107)	(0.0531)	(0.214)
Original p-value	0.24	0.37	0.71	0.27	-
RW p-value	0.29	0.35	0.53	0.31	-
School Pair FE	No	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes	Yes
Observations	105	105	105	105	105
R-squared	0.013	0.013	0.003	0.014	0.026

Note: This table presents OLS regression results for the impact of the program on teachers' financial literacy knowledge (dummies capturing whether they got the questions right). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). The index summarizes the scores and is standardized using the mean and standard deviation of the control group to facilitate interpretation and enhance comparability with other studies. Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

Figure 12: Financial Literacy - Dec/20

	Simple Interest	Compound Interest	Inflation	Risk Diversification	Average Score
Treatment	-0.00271	0.0249	-0.0104	0.0448	0.0615
	(0.0647)	(0.110)	(0.105)	(0.108)	(0.255)
Original p-value	0.97	0.82	0.92	0.68	-
RW p-value	0.99	0.99	0.99	0.98	-
School Pair FE	No	No	No	No	No
Unbalanced Variable	Yes	Yes	Yes	Yes	Yes
Observations	102	102	102	102	102
R-squared	0.003	0.036	0.005	0.002	0.008

Note: This table presents OLS regression results for the impact of the program on teachers' financial literacy knowledge (dummies capturing whether they got the questions right). Romano-Wolf correction of standard errors was employed so as to adjust for family-wise error rate when testing for multiple hypotheses simultaneously (Romano and Wolf, 2005). The index summarizes the scores and is standardized using the mean and standard deviation of the control group to facilitate interpretation and enhance comparability with other studies. Standard errors clustered at the school pair level are shown in brackets. Significance level markers: *10%; **5%; ***1%.

5 Conclusion

This paper sought to assess whether teachers training in active learning methodologies can affect their perceptions of students' academic prospects and their role in pupils' performance and plans. The program

we evaluate is a bundle of interventions that aim to make math classes more attractive to students in the transition to high school and to convey financial education concepts to them.

Despite the loss of statistical power, which arose due to the inclusion of some previously control schools in one of the programs offered by the intervention as a remedial measure in the face of the school closure in the period immediately after the outbreak of the pandemic, we still found some interesting and promising results.

Teachers assigned to receive two semesters of PBL training were more optimistic at the end of the intervention about the likelihood of their 9th-grade students completing high school, even in a period of great uncertainty and reduced student engagement. This result is quite relevant, as the education literature has increasingly shown the importance of teachers' beliefs about their students' potential in shaping these adolescents' expectations about their own academic path. These teachers also felt more experienced with remote teaching at the end of the first semester of school closures than their peers in the control group.

On the other hand, we observe an adverse effect of the program on some relevant socio-emotional skills. Treated teachers became more critical about their performance and ability to convey the content to their students despite their more optimistic outlook on their future. This may be related to the timing of the experiment and requires further investigation into the mechanisms behind it. Our work in progress on the implementation of the program in the following years (2021-2022), with an intervention including students and in a period of return to normality in schools, may shed light on the topic.

Our work also contributes to the literature on financial education, as it finds results suggesting that including financial education into the regular school curriculum can also positively affect teachers' financial awareness, corroborating some emerging evidence in this area.

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