Teacher Growth Mindset: Experimental Evidence of Offline and Online Training Methods

Tassia Cruz – FGV EBAPE

Ariana Britto – J-Pal

Alice Saccaro – UFF

Eduardo Sá – Stanford University

Letícia Côrtes – SME-RJ

Abstract

Teachers who believe in the malleability of intelligence foster environments that enhance student learning and resilience. This study investigates whether online professional development workshops can effectively shift teachers' mindsets and improve pedagogical practices compared to traditional in-person workshops. Conducted in Rio de Janeiro public schools, the study builds on previous research showing the effectiveness of in-person growth mindset workshops in enhancing equitable classroom practices and student performance. Using a randomized control trial design, data from both the 2019 in-person workshops and the 2021 online workshops were analyzed. The results showed that while the online workshops did not significantly change teacher mindsets or overall teaching quality, they did improve classroom time management. This highlights the potential of online training to influence specific teaching practices, especially in a post-pandemic context. These findings underscore the importance of understanding the unique challenges and opportunities of online teacher training, particularly in developing countries. (JEL C93, D83, I21)

1. Introduction

Mindset refers to individuals' underlying beliefs about the malleability of their intelligence and abilities. Teacher mindset is an essential aspect of education quality, as they not only shape teachers' beliefs, and their teaching practices, but also significantly impact their students' mindsets (Blackwell et al., 2007; Yeager et al., 2019) and academic outcomes (Dweck & Yeager, 2021). Teachers who believe intelligence and abilities can grow through effort and perseverance provide more helpful advice to students facing academic challenges (Rattan et al., 2012), present higher expectations of their students' learning (Rubie-Davies et al., 2015), fostering environments that enhance student learning and resilience.

This cascading effect highlights the importance of targeting teacher mindsets in professional development programs to foster positive student educational outcomes. It is possible to train teachers on the concept of a growth mindset, as the underlying beliefs about intelligence and abilities are indeed teachable and not fixed (Claro, 2016). However, teacher training programs are often costly and challenging to implement, prompting many education departments to explore online or hybrid methodologies to expand access. The COVID-19 pandemic significantly accelerated interest in online training, underscoring the urgent need to understand its effects more comprehensively. Despite their advantages, online workshops may fall short in critical areas compared to their offline counterparts. For instance, the lack of face-to-face interaction can result in weaker bonds between participants and facilitators, as well as among the teachers themselves, which can be crucial for consolidating learning. Additionally, the level of engagement in online workshops may be lower due to potential distractions such as toggling between windows or simultaneous use of mobile devices. These specific challenges highlight the necessity of discussing the unique difficulties inherent in online training, particularly when the objective is to analyze changes in beliefs regarding intelligence, including a growth mindset.

A previous study in Rio de Janeiro municipal public schools in Brazil demonstrated that in-person workshops designed to train teachers on growth mindset teaching practices could effectively shift teachers' beliefs towards a growth mindset. This shift was associated with notable improvements in teachers' pedagogical practices, with more equitable practices mainly in the classroom culture, significantly affecting student performance in Language and Mathematics (Cruz, Upcoming). These findings highlighted the critical role of teacher mindsets in shaping instructional practices, ultimately enhancing student achievement.

Building on these findings, this paper investigates whether the same workshop adapted for a virtual format can similarly enhance teachers' mindsets and subsequently improve teaching practices (given the known benefits of improved teaching practices on student outcomes). This paper brings novel evidence and results from an online version of the same mindset workshop previously given in person. The content of both online and offline workshops remained strictly the same, including the timing and workshop facilitators, ensuring a consistent basis for comparison between the two delivery methods. However, the virtual workshop included examples and references more directly related to racial equity, addressing the unique challenges and biases that students of diverse

backgrounds may face. This inclusion is based on growing evidence suggesting that addressing racial equity in educational interventions can enhance effectiveness by making them more relevant and impactful for teachers and students (Dee, 2004, 2005; Steele & Aronson, 1995).

This study compares the results of online and in-person teacher training workshops to provide insights into the most cost-effective strategies for teacher professional development, considering the known challenges of expanding quality teacher training programs in a developing country.

To compare the effects of online and in-person growth mindset workshops on teachers' mindsets and pedagogical practices, we analyzed data from two treatment years: 2019 for the in-person version and 2021 for the online version. In both iterations of the study, schools were randomly assigned to treatment and control groups. We estimated separate models to determine if teachers in treatment groups reported higher growth mindset scores than control group teachers. Our analysis included controls for social desirability, pair and coder fixed effects, school location, class designation, and various teacher and student characteristics, ensuring a thorough comparison of both workshop formats.

Our findings reveal that while the 2021 online intervention did not significantly impact teacher mindsets or the quality of teaching practices, it led to notable improvements in how teachers utilized classroom time—an effect not observed in the 2019 in-person workshops. This discrepancy suggests that although broader mindset changes were not evident, specific beliefs about the importance of effort were influenced. The unique context of 2021, marked by the return to in-person classes after prolonged COVID-19 school closures, likely intensified the focus on effective time management in classrooms. These results highlight the potential of online workshops to impact certain teaching practices, particularly in post-pandemic educational settings.

This paper is structured as follows. The introduction outlines the paper's objectives and significance. The literature review follows, contextualizing the current research within existing studies. The experimental design and data section is divided into in-person and online workshops detailing the intervention specifics, data collection methods, and study design. The empirical strategy section explains the methodologies used to evaluate the effectiveness of the online workshops and compare them with the in-person workshops. The results section presents findings on teachers' growth mindsets, pedagogical practices, and the use of classroom time using the TEACH+ classroom observation instrument. The

discussion section interprets these findings and their implications, while the conclusion summarizes the study and suggests directions for future research.

2. Literature Review

A growth mindset refers to the belief that intelligence and abilities are not fixed and can be developed over time (Dweck, 2006; Dweck et al., 1995; Dweck & Leggett, 1988; Yeager et al., 2016). This perspective emphasizes the potential for individuals to improve their skills and intelligence through effort, learning strategies, and overcoming challenges. When introduced, this idea attracted the attention of educators, economists, and psychologists, who began investigating how the notion that intelligence is malleable can impact student performance in basic education (Dweck & Yeager, 2021).

Several studies have shown that students with a growth mindset tend to achieve better academic results than those with a fixed mindset. A growth mindset is associated with increased motivation, greater resilience in facing challenges, and greater engagement in school activities. In a seminal study, Blackwell, Trzesniewski, and Dweck (2007) found that interventions promoting a growth mindset in middle school students significantly improved their math grades. Years later, in a large-scale experiment involving more than 12,000 high school students in the United States, Yeager et al. (2019) demonstrated that a brief online intervention designed to promote a growth mindset in adolescents led to increased grades and enrollment in math and science courses among underrepresented minority students.

Despite the potential benefits, implementing growth mindset interventions faces challenges. Not all interventions are equally effective, and their success may depend on contextual factors such as the school environment and teacher support. Research conducted by Yeager and Dweck (2020) on the main learnings and bottlenecks in growth mindset interventions highlights that while student-targeted growth mindset interventions have been more effective than those targeted at teachers, further research is needed to better understand how these interventions can be optimized to influence the educational environment more effectively.

Because teachers are the primary authority figures in the classroom, their practices (i.e., what they say and do) have a powerful effect on the classroom culture. Evidence has shown that one strategy for a teacher to remedy a fixed mindset classroom culture may be to adopt practices that intentionally foster a growth mindset classroom culture.

Research shows that messages conveyed by teachers affect their students' academic performance. Hecht et al. (2023) developed an intervention that motivated high school teachers to adopt classroom practices that support a growth mindset, improving academic performance in classes with a higher proportion of students in socially vulnerable situations. Shoshani (2021) evaluated the effects of a program aimed at promoting growth mindsets for high school math teachers in Israel, focusing on improving practices and student performance in math. One year after the intervention, the results showed significant improvements in teachers' professional well-being and emotional teaching effectiveness, resulting in increased student grades and decreased dropout rates compared to a control group.

However, an important question to be answered is how we incorporate growth mindsets into pedagogical practices and, consequently, into teachers' classroom language, i.e., how do teachers convey this concept to students? Handa et al. (2023) established a training tool to reframe unfavorable statements into teachers' growth mindset supportive language. The evaluation involved 174 teachers and 1006 students in the U.S. and focused on using a scalable tool, ChatGPT-4, to generate supportive language for teachers to build growth mindsets in the classroom. The results showed that both teachers and students perceive GMSL-trained teacher and model reframings as more effective in fostering a growth mindset and promoting challenge-seeking behavior. However, influencing teachers to incorporate this growth-mindset-oriented feedback can be incredibly difficult to do at scale.

The effectiveness of teacher training interventions can also vary significantly depending on the delivery method. Typical professional development for teachers in evidence-based preventive interventions consists of one-time in-person training workshops (Darling-Hammond, Wei, Andree, Richardson & Orphanos, 2009). In-person training demands more resources, requires more time commitment from teachers, and incurs costs for participation. It also lacks flexibility due to being constrained within a pre-established workshop schedule.

In the context of program expansion, the logistics of in-person training, including providing face-to-face training materials, go beyond the resources of most school systems. Hence, it is important to develop flexible, accessible models that demand fewer resources and can be scaled. At the same time, finding models that deliver comparable or better results than those achieved by face-to-face training. In this context, online training has been tested as a potential alternative to in-person training. Becker et al. (2014)

explored online and face-to-face training for preschool and 1st to 5th-grade teachers between 2011 and 2012. The study compared the implementation quality between teachers who participated in online training plus face-to-face mentoring and those who received training and mentoring in person. The results indicated that teachers in the hybrid group achieved a similar level of implementation quality to teachers in the in-person group, highlighting the potential of the Internet as a promising component in training.

Mindset interventions offer participants new beliefs that encourage them to face challenges rather than avoid them and persist rather than give up. The evidence seems to demonstrate that by putting these beliefs into practice—primarily through teachers—interventions can improve students' cognitive and non-cognitive outcomes. The channels through which these changes occur, whether through pedagogical practices, language changes, or changes in teachers' beliefs, still seem unclear. This article contributes to this literature by addressing an online growth mindset intervention focused on teachers.

3. Experimental Design and Data

3.1. In-person workshops

3.1.a. Intervention Details

The in-person intervention was a workshop consisting of five half-day sessions at the Paulo Freire Training School, a teacher training institution in Rio SME. The intervention was made possible through a partnership between the Education Secretariat and our research team. The sessions took place once a week for fifth-grade teachers at the beginning of the school year (March and April 2019). The purpose of the workshop was to promote pedagogical practices that encourage a "growth mindset." The content and presentation method for the workshops were defined by our research team, based on previous research, in partnership with a specialist in emotional literacy and a teacher from the municipal network of Rio de Janeiro. The workshops were conducted by teacher trainers from the Rio network rather than researchers. This choice was important because the trainers were more attuned to using the right language with teachers. Furthermore, we believe that the trainers' classroom experience in a public network was crucial for establishing a connection with teachers and enabling an actual change in their mindsets.

The workshops focused on cultivating the belief that intelligence can be developed through persistent effort, resilience, and continuous growth. The first workshop introduced the concept of mindset theory, which suggests that the human brain can

develop, as do the muscles. It also explored how mindsets can influence the learning process. The goal was to help teachers identify fixed mindsets and encourage them to embrace challenges and problem-solving to enhance student learning. The second workshop emphasized the significance of understanding mistakes and their role in the learning journey. It also addressed the impact of external influences, such as parents, peers, and teachers, on a student's mindset and learning abilities.

The third workshop had two main learning objectives: understanding that some strategies can help students deal with frustration and realizing that learning is a journey full of mistakes and frustrations. The workshop stressed the significance of adopting a growth mindset to deal with frustration (Paunesku et al., 2015). It also encouraged participants to reflect on the essential role of effort in the learning process. Moving on to the fourth workshop, the content underscored the significance of combining effort with strategies to attain set goals. Additionally, it highlighted the detrimental impact of endorsing negative stereotypes in the classroom, which can increase the likelihood of academic underachievement.

The fifth and final workshop aimed at achieving the following learning objectives: (1) Establishing a connection between stereotype threat and the concept of Mindset, (2) Presenting some "Mindset traps,"[1] (3) Promoting a discussion of practices to create a safe classroom environment, and, finally, (4) Connecting the knowledge acquired throughout the workshop cycle. In this workshop, teachers studied anecdotal cases involving students with different stereotypes. The goal of this work was to encourage participants to solve a given situation after reflecting on issues related to stereotype threat and self-fulfilling prophecy (Good et al., 2003; Steele & Aronson, 1995).

3.1.b. Data Collection

We revisited the sample schools in October and November 2019 and carried out one-hour classroom observations using the TEACH+ methodology. Additionally, we distributed surveys to teachers and students to assess their growth mindset and gather personal

[1] The workshop presents two "Mindset traps." The first "Mindset trap" refers to the belief that some children cannot learn, but instead of considering the child more or less 'intelligent,' it is justified by the fact that the child has a 'fixed mindset.' In the second "trap," the growth mindset leads to the idea that believing, by itself, is enough to improve academic outcomes – and not that believing is a necessary step for changing behaviors that may lead to improved outcomes. In Portuguese, there is a saying present in a famous kids' song that says: "*Tudo pode ser…só basta acreditar*" – which refers to the idea that all dreams can come true if you believe in them. In all workshops in the interventions, teachers brought up this idea, which was an important transition to discuss the second "Mindset trap."

information. The surveys included questions about personal characteristics, professional details (for teachers only), inquiries regarding growth mindset, and social desirability. Students were given guidance from the visiting researcher before completing the survey. We evaluated the teachers' growth mindset using the "Implicit Theory of Intelligence Scale" (ITIS) developed by Abd-El-Fattah and Yates (2006). This 14-item questionnaire measures the implicit theory of intelligence, which is the belief that people can develop their intelligence through learning new skills. In our study, we utilized all the survey items and translated the questions into Portuguese after agreeing on a version through two independent translators. We then tested the understanding of the questions in pilot focus groups to ensure they were interpreted as intended and adapted to the specific context of fifth-grade teachers in the municipal public schools of Rio de Janeiro.

To address the potential impact of social desirability on our results, we included questions designed to uncover whether participants were more likely to provide answers they thought were socially acceptable rather than their genuine opinions. These questions were taken from Reynolds (1982) adapted version of the social desirability scale developed by Crowne and Marlowe (1960). They included 13 items asking participants to what extent they agreed with socially desirable statements rarely practiced in real life, such as "I am always willing to admit that I made a mistake." By incorporating these questions into some of our models, we aim to reduce the influence of socially desirable responses on our growth mindset results.

We collected classroom observation data to evaluate the effects of our intervention on teachers' pedagogical practices. We use a standardized classroom observation instrument called TEACH+, which combines measurement of "Teacher Use of Time"—teacher time on task, types of pedagogical practices, and student engagement, drawn from the Stallings "classroom snapshot" method (Bruns & Luque, 2014)—with measures of instructional quality ("Quality of Teaching Practices") embodied in the TEACH instrument developed by the World Bank in 2018 (Molina, Fatima, et al., 2018).[2]

Our instrument divides the "Quality of Teaching Practices" component into three main areas: "classroom culture," "instruction," and "socioemotional skills," which consist of 28 behaviors organized into nine elements. These behaviors are evaluated in a single session through two 15-minute observations and are categorized as low, medium, or high based

[2] I thank Barbara Bruns and Fatima Alves for adapting the instrument and training the observers to collect the data in Rio de Janeiro.

on the evidence collected. The scores for these behaviors are then converted into a five-point scale, providing a quantified assessment of the teacher's techniques in the classroom (Molina, Pushparatnam, et al., 2018).

"Classroom culture" refers to a teacher's ability to create an environment that supports effective learning for all students. This includes promoting respect, using positive language, addressing individual student needs, and avoiding gender stereotypes. It also involves setting clear behavioral expectations, recognizing positive behavior, and effectively managing negative behavior. "Instruction" evaluates how well teachers foster critical thinking and analytical skills, communicate lesson objectives, provide clear explanations, connect activities to the content or students' lives, and assess student understanding. It also measures how teachers adjust their teaching strategies, offer constructive feedback, and encourage critical reasoning through open-ended questions and reasoning tasks. "Socioemotional skills" assess a teacher's ability to promote student autonomy, perseverance, and social and collaborative skills by providing opportunities for decision-making, acknowledging student efforts, treating mistakes as a natural part of the learning process, and fostering teamwork and interpersonal abilities through peer engagement.

For the “use of class time” indicator, observers take 10 “snapshots” of the classroom at regular intervals throughout the class and encode what the teacher and students are doing at that moment. The “snapshot” refers to observing what the teachers and the students are doing at that exact moment of the class (Bruns et al., 2018). The indicator categorizes classroom activities into three groups: "instructional activities," "classroom management," and "teacher off-task." "Instructional activities" encompass academic activities conducted during class time, including six common pedagogical strategies: copying, assignment/class work, practice and drill, discussion/debate, demonstration/lecture, and reading aloud. "Classroom management" involves the teacher's actions in disciplining or organizing the classroom. "Teacher off-task" denotes instances when the teacher engages in non-class-related activities during class or is absent from the classroom.

Twenty-two coders conducted classroom observations and administered teacher and student surveys during the school visits. To guarantee the comparability and quality of the collected data, the coders were certified and required to follow strict protocols during school visits. During the fieldwork, two supervisors certified in the TEACH+

methodology were present to provide support to the coders with logistical or technical queries related to the instruments.

School visits were not scheduled. Schools were informed about the period of data collection, but the dates of the visits were not shared.[3] This was done to ensure that the closest possible observation of a regular class was achieved. During the one-hour class period, the coder sat at the back of the classroom and took notes. The aim is to avoid disturbing the class dynamics as much as possible. Although the presence of an external individual in a fifth-grade classroom may not go unnoticed by students, there is no reason for any possible disturbances in the classes to differ between the treatment and control schools.

The teachers also did not know the evaluation instruments that would be utilized; the growth-mindset questionnaire (ITIS questions) was not shared with the teachers (we did not administer the survey prior to the intervention), and the teachers were only informed about how the visit would be, but had no information on the categories of analysis of the TEACH+ instrument. Although teachers in treatment schools could have tried harder to impress the coders, the fact that they did not know the exact categories of evaluation makes it unlikely that this could bias our estimations.

3.1.c. Study Design

In 2019, we invited all schools in Rio de Janeiro municipality with one or two fifth-grade classes to a meeting where we explained the research objectives. Out of 395 such schools, representatives from 252 attended the meeting, and 178 schools agreed to participate by signing a consent form. For participation, both fifth-grade teachers in a school with two classes had to consent, resulting in an initial sample of 323 teachers from 178 schools: 164 from treatment schools and 159 from control schools.

We used a two-level clustered randomization approach with treatment at the school level. To carry out the randomization, we paired schools based on the predicted student performance, calculated from the characteristics of the schools in previous years. We used data from the student performance standardized exam (SAEB) in 2015 and 2017 (Brazil,

[3] The protocol was different for the schools in areas of armed conflict. They corresponded to 45 of the 178 sample schools, according to the Secretariat of Education's determination of "conflagrated areas." In these schools, the visit date was shared with the school less than a week before the visit. This action was necessary for the school to warn the research team if a shooting happened on the visit date. Even with this precaution, during three school visits, coders witnessed shootings in the surrounding community. In these situations, the classroom observation and survey application were rescheduled.

2015, 2017), as well as the School Census in 2016 and 2018 (Brazil, 2016, 2018) to predict the likely scores that schools would achieve on the mathematics standardized exam in 2019. Then, we used these predicted values to match the schools.

To calculate the coefficients to make the prediction, we estimated a regression model of 2017 SAEB mathematics results on previous years' characteristics in the schools. In this model, we included the 1st, 10th, 25th, 50th, 75th, 90th, and 99th percentiles for Portuguese and mathematics (in addition to school averages across subjects). We also included in the prediction regression model the number of fifth-grade classes participating in the schools' SAEB test, in addition to some student characteristics.[4] Using the estimated coefficients, we then calculated the predicted values for each school's 2019 SAEB math results.

Then, we organized the schools in pairs, considering the closest values (from lowest to highest) to the 2019 SAEB math predicted values. Nine out of the 178 enrolled schools did not have data from the 2017 SAEB, so we used only the 2018 School Census data to predict the 2019 SAEB results. After pairing, we generated a random value for each school, and the school with the highest value generated in each pair was assigned as the treatment and the pair as the control. After a random draw, we disclosed the results of the schools selected to participate in the workshop. Subsequently, we distributed the treated teachers into the eight workshop classes based on their preferred times.

Table 1 shows that treatment and control schools are similar in observable traits, measured by the surveys applied to teachers and students. The exceptions are more teachers' years of schooling and a higher proportion of girls in treatment schools. Additionally, three variables of parents' education indicate that students in control schools have more educated parents. To account for these differences, we added controls for the teachers' and students' characteristics to our analysis, as well as pair fixed effects.

[4] As characteristics of fifth-grade students, we included students' average age, the proportion of girls, the proportion of Black and *pardo* students, and the proportion of students with special needs, drawing on data from the SAEB student survey and school size (total number of classes in the school) from the School Census data.

Table 1: Comparisons by treatment status in 2019

	Treatment		Control		Diff
	N	Mean/SD	N	Mean/SD	Mean/SE
Teacher's characteristics:					
Women	153	0.96	122	0.95	-0.01
		(0.19)		(0.22)	[0.02]
Black	145	0.17	116	0.20	0.03
		(0.38)		(0.40)	[0.05]
Age	146	46.01	113	46.83	0.81
		(9.98)		(10.44)	[1.27]
Years of schooling	152	16.39	121	16.15	-0.25
		(1.18)		(1.34)	[0.15]*
Tenure	151	17.01	121	18.41	1.40
		(0.90)		(1.00)	[1.35]
Works in another class	150	0.27	121	0.31	0.04
		(0.44)		(0.46)	[0.05]
Students' characteristics:					
% of girls	153	52.86	122	50.05	-2.81
		(9.68)		(10.72)	[1.23]**
% of Blacks	153	16.80	122	16.34	-0.45
		(10.43)		(10.36)	[1.26]
Mean age	153	11.02	122	11.05	0.03
		(0.34)		(0.35)	[0.04]
% of students whose mother knows how to read, and is seen reading	153	88.23	122	85.24	-2.99
		(32.32)		(35.61)	[4.10]
% of students whose father knows how to read, and is seen reading	153	73.85	122	83.60	9.75
		(44.09)		(37.17)	[4.99]**
% students whose mother has a university degree	153	7.18	122	15.57	8.38
		(25.92)		(36.41)	[3.76]**
% students whose father has a university degree	153	11.11	122	20.49	9.38
		(31.53)		(40.53)	[4.34]**
Standardized Socioeconomic Level Index	153	0.00	122	-0.03	-0.03
		(1.11)		(0.89)	[0.12]

Notes: N refers to the number of classes, excluding missing answers.

Source: Teacher and student surveys were conducted in 275 classes across 152 schools in November 2019.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

In Brazil, fifth-grade classes are usually taught by a single teacher for all subjects except physical education and the arts. We randomly selected schools rather than individual teachers to avoid treatment spillover among teachers within the same school. The 178 participating schools were split into 89 treatment and 89 control schools. Of the 164 teachers in the 89 treatment schools, 127 attended at least one workshop session. However, the attendance varied, with 117 teachers attending the first and 103 attending the final sessions. Punctuality also varied, with 37 out of the 117 teachers arriving late for the first meeting. Additionally, six "always-takers" from three control schools attended the first workshop, with two continuing through the second day but missing the remaining sessions.

We also had some attrition with the data collection. Some schools from the sample were excluded due to teachers refusing to complete surveys or allow class observations. Of 323 teachers across 178 schools, 273 completed the survey (including the teacher mindset

questions[5]), and 274 classes were observed in 151 schools—divided into 152 classes in 82 treated schools and 121 classes in 69 control schools. That means we lost seven treatment and 20 control schools during data collection. The 27 lost schools are spread throughout Rio's municipality and do not suggest any regional bias in the attrition. Furthermore, the size of the lost schools is similar for both treatment and control groups.

3.2. Online workshops

3.2.a. Intervention Details

The challenge of developing a workshop to affect teachers' mindsets gained specific contours on the second wave of the research in 2021 by moving to an exclusively online format. Thus, combining the foundational structure of the trainings conducted at the Rio de Janeiro Municipal Secretariat of Education (SME) in 2019 on teachers' mindsets with elements on racial issues, the new wave adapted the content to allow the discussions and reflections present in the 2019 intervention to happen in the online format.

The teacher training workshops in 2021 consisted of five online meetings, each lasting two hours, held between June and July 2021. It is worth noting that the online workshops in 2021 were scheduled for later in the year, while the 2019 in-person workshops took place between March and April. The exact impact of this timing difference is not entirely clear. On the one hand, the proximity of the 2021 workshops to the data collection period may result in teachers retaining more of the content. On the other hand, the earlier timing of the 2019 workshops gave teachers more time to create activities and implement what they had learned.

In 2021, 154 teachers from 90 schools were split into six groups for the online workshops. The same two SME teacher trainers from 2019 conducted the 2021 online workshops. There was also a training assistant who supported each workshop group. The themes that were addressed in 2019 remained the basis for the new format of learning. However, in 2021, the case studies and examples focused solely on anti-racist issues. The research team's hypothesis for this focus was that deliberately reshaping symbolic references and contextual examples to create connections and a sense of belonging with black people could help reduce barriers to racial equity in the educational outcomes of students in the Rio de Janeiro Municipal School Network.

[5] We applied teacher and student surveys in 275 classes, but the teacher mindset questions were answered in 273 of them.

The feedback from the workshops revealed that teachers needed support addressing racial issues in their classrooms. Many teachers struggled to understand how racial differences could impact students' experiences, such as how mistakes can be perceived differently for black and white students. It was also evident that some white teachers felt uneasy discussing racial topics; it seemed that for many teachers, this discussion was not present in their daily lives. Despite the workshops highlighting the impact of racial problems on everyday school life, many teachers focused on their personal racial experiences rather than issues experienced in the classroom. Another relevant aspect was the low racial literacy of the teachers, which limited some discussions. Regardless of the level of knowledge about racial issues in various social contexts, the aim was to promote discussions and reflections on the topic to affect participants' mindsets—however, the superficiality of such knowledge limited connections and possible transpositions to pedagogical practice.

When comparing the in-person intervention in 2019 to the online and synchronous workshops in 2021, it is clear that the characteristics of the remote workshops significantly influenced the outcomes. The physical distance created by computer screens made it challenging for participants to interact and comprehend the material. While motivational factors are fundamental in a formative process that envisions changing the mindset of those involved (Bondie and Zusho, 2023), the lack of "eye-to-eye" contact between teachers and trainees may have hindered the creation of an environment that fosters motivation.

Despite having guiding commands and a research assistant for technology support, teachers faced difficulties engaging in virtual workshops using the Zoom platform. Problems with internet connectivity affected group activities in breakout rooms, and accessing the platform on different devices was also challenging. Due to poor connectivity in many schools, some teachers could not use their cameras or microphones during the workshop. These difficulties interfered with the workshop's progress and activities, leading to necessary adjustments in workshop times.

In summary, although numerous efforts were made to qualify the operationalization of the workshops on teachers' and students' mindsets – considering a more focused racial perspective – at Rio de Janeiro’s municipal public school system, the challenge of executing them remotely was enormous. The obstacles to utilizing the virtual environment and its resources may have significantly contributed to the lack of progress

in changing beliefs and, consequently, affected the results of the research approach adopted in 2021.

3.2.b. Data Collection

During the last two weeks of November and the first week of December 2021, we conducted the data collection for the second phase of our research. We used the same tools as in 2019 for data collection, which include: (i) Surveys to gauge the mindsets of teachers and students in 98 schools and (ii) Observation of teachers' pedagogical methods in the classroom using the TEACH+ instrument in 92 schools.[6]

During the observation period, surveys were to be filled out and handed in at the end of the observer's visit, similar to the process in 2019. Nine coders and two field supervisors, certified in the TEACH+ methodology, who had participated in the 2019 data collection, were selected for classroom observation. They received four days of training for the 2021 data collection.[7] These observers visited the selected schools, used the TEACH+ methodology to observe classrooms, and administered surveys to students and teachers.

3.2.c. Study Design

Like 2019, the 2021 sample comprises schools from Rio de Janeiro's Municipal Education Network with one or two fifth-grade classes. Also, similar to 2019, we invited all schools fitting this profile to participate in the study (including the treatment and control schools of 2019). In total, 386 schools were invited. Out of these, 229 schools registered for the study, 130 of which were part of our sample in 2019, and 99 are new schools. We randomly divided the new schools into treatment and control groups.

In accordance with our agreement with Rio's Secretariat of Education,[8] all control schools from 2019 were selected to participate in the workshop. Additionally, 49 schools from the new sample were randomly chosen to participate. As a result, the 2021 online intervention was conducted for 152 teachers across 90 schools. Data collection, however,

[6] We have also applied an additional instrument designed to evaluate the effect of our intervention on racial equity in schools – the 'Racial Equity in the Schools Scale' (RESS) – not evaluated in this study.

[7] As it was designed for observers who had already been certified in 2019, the distinguishing feature of the 2021 TEACH+ training was that, by recalling concepts previously known to the group of participants, more time could be dedicated to working with real examples (seen in 2019 and/or likely to be encountered in 2021). The idea of aligning perspectives so that the observation categories of the TEACH+ instrument did not differ, either among themselves or between observers, was of utmost importance for the reliability of the results obtained.

[8] In 2019, we agreed with Rio's Secretariat of Education that all control schools would have a chance to participate in future training provided by our research team.

was only conducted for the 99 schools that joined the study in 2021,[9] comprising 49 treated schools and 50 non-treated ones. In summary, our sample consisted of four groups: (1) 89 schools that received treatment in 2019, (2) 41 schools that served as the control in 2019, (3) 49 schools that entered the study in 2021 and were assigned to treatment, and (4) 50 schools that entered the study in 2021 and were assigned to the control group. Our sample in the present study refers to groups (3) and (4), which include 177 fifth-grade classes – 90 in the treatment and 87 in the control group.

To randomize the schools between treatment and control, we used a model that was very close to the one used in 2019. We began by predicting the 2021 IDEB scores in Portuguese and Mathematics based on the 2019 IDEB data. To do this, we conducted a regression analysis using scores from schools with proficiency averages falling within specific percentiles of proficiency. Subsequently, we applied a propensity score method, using a linear regression model to generate a score that matched schools in the sample based on their 2019 demographics and predicted 2021 performance. After pairing the schools, a random draw was performed within each pair to determine the treatment and control groups. Schools without SAEB 2019 score data were randomized into either the treatment or control groups.[10]

Table 2 compares observable variables measured by our teacher and student surveys in our treatment and control groups in 2021. Most variables show no significant differences between the treatment and control groups. The variables that do show significant differences across the treatment status (with p-values below 0.05) are teacher tenure (with more experienced teachers in the control group), percentage of Black students (with a higher percentage in treatment schools), and two variables related to parents' education (with more educated parents in treatment schools). However, these differences do not indicate a clear pattern of more or less vulnerable students in any of the groups. In any case, our preferred models include controls for teacher and student characteristics.

[9] Initially, our goal was to collect data on all 229 schools to analyze the long-term effects of the 2019 intervention. However, given the increased data collection costs after the pandemic, our budget only allowed us to collect data on part of it. So, we decided to focus on the 99 new schools that did not participate in the 2019 intervention.

[10] As the demographic characteristics, we used the number of fifth-grade classes in the school, Percentage of black students in the school, Percentage of pardo students in the school, Mother's education level, student SES level (considering whether students have a refrigerator, computer, bathroom, car, washing machine, and freezer at home).

Table 2: Comparisons by treatment status in 2021

	Treatment		Control		Diff
	N	Mean/SD	N	Mean/SD	Mean/SE
Teacher's characteristics:					
Women	90	0.94	87	0.89	-0.05
		(0.23)		(0.31)	[0.04]
Black	81	0.15	79	0.16	0.02
		(0.36)		(0.37)	[0.06]
Age	90	46.57	83	48.48	1.91
		(10.26)		(10.50)	[1.65]
Years of schooling	89	17.20	86	17.31	0.11
		(1.20)		(1.32)	[0.19]
Tenure	89	16.36	84	19.21	2.85
		(9.59)		(10.98)	[1.56]**
Works in another 5th-grade class	87	0.24	82	0.19	-0.05
		(0.43)		(0.40)	[0.06]
Students' characteristics:					
% of girls	90	43.33	86	44.19	0.85
		(49.83)		(49.85)	[7.52]
% of Blacks	90	18.89	86	8.14	-10.75
		(39.36)		(27.50)	[5.14]**
Mean age	90	10.93	86	10.91	-0.02
		(0.27)		(0.25)	[0.04]
% of students whose mother knows how to read, and is seen reading	90	84.44	86	83.72	-0.72
		(36.45)		(37.13)	[5.55]
% of students whose father knows how to read, and is seen reading	90	84.44	86	74.41	-10.03
		(36.45)		(43.89)	[6.07]*
% students whose mother has a university degree	90	20.00	86	8.14	-11.86
		(40.22)		(27.50)	[5.22]**
% students whose father has a university degree	90	17.78	86	15.12	-2.66
		(38.45)		(36.03)	[5.62]
Standardized Socioeconomic Level Index	90	-0.01	86	0.00	0.01
		(0.28)		(0.34)	[0.05]

Notes: N refers to the number of classes, excluding missing answers.

Source: Teacher and student surveys were conducted in 176 classes across 98 schools in November and December 2021.

*** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

As we are estimating the intent-to-treat effect (ITT), we have two potential attrition problems. The first refers to the attrition in the intervention, referring to teachers who were assigned to treatment but did not participate (or did not fully participate). In the online version of the workshop, 44 of the 152 teachers from the selected schools did not attend any of the five workshop sessions. Contrary to our expectations, the anticipated positive effects of including racial equity content on engagement did not materialize in the online workshop. A total of 108 teachers attended at least one session; among them, 69 teachers completed most of the workshop by attending four or more sessions. The

attendance rates varied across different CREs, with CREs 5 and 10 showing the highest attendance rates, while CREs 3 and 8 had the highest absence rates.

The second attrition issue refers to data lost during data collection. While the intervention attrition was higher in 2021 compared to 2019, the data collection attrition was much smaller – we only lost in 2021 one school (from the control group) for the teachers' surveys, and eight schools (four in the treatment and four in the control group) for the classroom observations. Therefore, we have complete data for 98 schools on teachers' mindsets and 91 schools on classroom observations. From the 177 fifth-grade classes, we have 176 answered teachers'[11] and students' surveys and 161 with complete classroom observation data: 81 classes in treatment and 80 in control schools, meaning that nine classes in treatment and seven in control schools did not have their classes observed.

In addition to being small, the attrition does not seem to be related to any specific characteristics of the schools. The regional distribution of the schools—which might indicate being in a poorer area of the city—is not remarkably different. Of the four non-observed treatment schools, two are from CRE 2, one from CRE 4, and one from CRE 6. Of the four control schools lost, two are also from CRE 2, one from CRE 7, and one from CRE 8. Considering the number of students in grades one to five, the size of the schools is not statistically different across the lost four treatment and four control schools. The size of these eight schools is also statistically similar to that of the other 91 schools in the sample.

4. Empirical Strategy

We are interested not only in whether the online version of the treatment could influence teachers' growth mindsets and pedagogical practices but also in how this effect is different from the in-person version of the workshop. For that, we first estimate separate models for the different years of treatment (2021 with the online version and 2019 with the in-person version).[12] As presented in Equation 1 below, we estimate whether teachers in schools randomly assigned to the treatment group (separate for 2019 and 2021) were likelier to report a higher growth mindset than teachers in control schools in that specific year, where k refers to schools and j refers to classes. As controls, we include an index of

[11] We have gender information for all the 177 teachers of the sample.

[12] We could estimate a stacked model with the 2019 and 2021 interventions to analyze the incremental effect of the in-person treatment versus the online one. However, a stacked model would not let us clearly analyze the 2021 intervention effects, so we decided to present the models estimated separately.

social desirability, pair, and coder fixed effects[13], and controls for the school location (the regional coordination the teacher teaches), class designation (whether the class is 1501, 1502, or 1503)[14], and teacher and student characteristics.

By year = 2019 or 2021:

(1) $$Teachers\ Growth\ Mindset_{kj} = \beta_0 + \beta_1 Treatment\ school_k + \beta_2 Social\ Desirability_{kj} + \beta_3 Pair\ FE_k + \beta_4 Coder\ FE_k + \beta_5 Class\ designation_j + \beta_6 School\ location_k + \beta_7 Teacher\ charact_k + \beta_8 Student\ charact_k + \varepsilon_{kj}$$

Outcome variables and controls were standardized, including teachers' growth mindset and social desirability. For the teacher and student characteristics, we use the variables from the data collected in the teacher and student surveys, respectively. The teacher characteristics include teachers' gender, age, race (proportion of black teachers)[15], schooling level (proportion of teachers with at least a university degree)[16], tenure (years working as a school teacher), and whether the teacher teaches more than one fifth-grade class. The student characteristics include gender, age, race (proportion of Black students)[17], an indicator for student socioeconomic status (SES, considering items in the house)[18], whether the student plans to go to the university, and variables for mother (or the women responsible for the student) and father (or the man responsible for the student) education – whether the mother or father knows how to read and write and whether the student actually sees the mother or father reading, and the education level of the mother

[13] The coders who did the classroom observations were the same who applied the surveys. Even though there was a specific protocol for how the coder should apply the protocol, there may be specific patterns for how the coder behaves, so we include fixed effects for the coders in our preferred models.

[14] The class designation is a proxy for "unofficial" tracking in the school system. There is evidence in Rio de Janeiro's municipality that schools divide the students by previous performance, and the higher the class designation, the lower the average student performance of the class (Mendes e Costa 2023).

[15] We asked the teachers to mark their race within the categories: white, Black, "pardo," and yellow, Indigenous, or non-declared. These categories follow the Brazilian Institute of Geography and Statistics (IBGE), which researches the color or race of the Brazilian population based on self-declaration. Some authors categorize "pardo" as brown/mixed race (Loveman, Muniz, and Bailey 2012; Telles 2002).

[16] We asked the teachers to mark their education level within the categories of high school, university degree, Post-graduation, Master's, Doctorate, or another degree.

[17] We asked the students to mark their race within the categories: white, Black, "pardo," yellow, or Indigenous, and if the student marked that she did not know her race.

[18] The index refers to the standardized (mean zero and standard deviation one) weighted total number of items reported by the student. We followed the "Criterio Brasil 2022" weights for calculating the SES index, considering the items present in the student house (ABEP 2022). The items in the house considered in our indicator are: bathroom, housemaid, car, computer, washing machine, dishwasher, refrigerator, and freezer.

and father (proportion of university education level)[19]. Imputation was used for student and teacher missing data used as controls in the regression.

We ran similar models for the treatment effects on pedagogical practices measured by the TEACH instrument, except that we did not include the social desirability control since the outcome is measured by coders who observed the classes. In the models for the effects on pedagogical practices, we also include a control for the subject being taught by the teacher at the time of the observation (since fifth-grade teachers are "generalist," meaning that they teach all the main disciplines, the coder could observe classes with Mathematics, Portuguese Language, Social Sciences, Nature Sciences, or others). As outcomes, we have the overall TEACH indicator and separate estimations for classroom culture, quality of instruction, and the promotion of socio-emotional skills in the classroom, as measured by the TEACH instrument.

Finally, we estimate the effect of the treatment on the teacher's time use. As there are ten "snapshots" in each observed class, the number of observations is ten times the number of classes. Since the classes may evolve in specific patterns – teachers may, for example, spend more time at the beginning of the class "organizing the classroom" (distributing materials, for example) – we include controls for the moment of the observation (from one to ten). The other controls are similar to the ones presented in Equation (1), except for social desirability (similar to the models estimated for the TEACH indicators).

5. Results

5.1. Teachers' Growth Mindset

As presented in Equation (1), we first estimate the effect of participating in the in-person or online workshops in April 2019 and June and July 2021, respectively, on the teachers' growth mindset indicator measured at the end of the respective years. Table 3 presents the results of this first estimation, with the first three columns referring to the estimation with 2019 data and the last three with the 2021 results. Columns [1] and [4] present the estimated results, including only the pair and coder fixed effects. Columns [2] and [5] show the results by additionally including the social desirability indicator and the controls

[19] We asked the students to mark their parents' education level within the categories: Elementary incomplete, Elementary, Middle school, High school, University degree, and if the student does not know the mother/father's education level.

for class designation and school location. Finally, columns [3] and [6] include all controls presented in Equation (1), including teacher and student characteristics.

Table 3: Treatment effect on Teachers' Growth Mindset

	Teacher's Growth Mindset 2019 (In-person)			Teacher's Growth Mindset 2021 (Online)		
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment school	0.506	0.545	0.565	0.251	0.170	0.211
	[0.123]***	[0.138]***	[0.141]***	[0.132]*	[0.140]	[0.158]
R^2	0.48	0.54	0.60	0.32	0.44	0.58
N	273	273	273	176	176	176
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes	Yes	Yes
Social desirability	No	Yes	Yes	No	Yes	Yes
Class designation	No	Yes	Yes	No	Yes	Yes
School location	No	Yes	Yes	No	Yes	Yes
Teacher charact	No	No	Yes	No	No	Yes
Student charact	No	No	Yes	No	No	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$
Sources: Standard errors clustered at the school level. Teacher and student questionnaires were applied in November 2019 and November and December 2021. The Teacher's Growth Mindset questions are adapted from the Implicit Theory of Intelligence Scale (ITIS) (Abd-El-Fattah and Abd-El-Fattah, 2006).

From the results presented in Table 3, we find that while the effects of participating in the in-person workshop are positive (p<.01) and robust to the inclusion of controls, the estimated effect for the online version of the workshop is close to half of the coefficient estimated from the in-person intervention, but also the positive results are not robust to the inclusion of controls—$\beta_1(2021) = .211$ (p-value > .10) and $\beta_1(2019) = .565$ (p-value < .01) in the complete models, as presented in columns [6] and [3], respectively. Therefore, we cannot affirm that the online intervention has affected teachers' growth mindset. It is clear, however, that if it had any effect on teacher beliefs, it is at least half of the effect found in the in-person version.

5.2. Pedagogical Practices

5.2.a. TEACH

We then analyze the estimated effects of the workshops on pedagogical practices, considering the classroom observations instrument. We first estimate the treatment effect on the overall quality of teaching practices, measured by the TEACH indicator. Table 4 presents the results of the estimated effects as we include new controls. As shown in the first three columns, we find that our in-person treatment had a positive effect on the

TEACH indicator. Our preferred model, presented in column [3] of Table 4, shows the estimated coefficient $\beta_1 = .446$ (p-value < .01) when including all control variables.

Table 4: Treatment effect on TEACH indicator

	Std (Teach score 2019) In-person			Std (Teach score 2021) Online		
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment school	0.349	0.347	0.446	0.155	0.139	-0.039
	[0.104]***	[0.104]***	[0.118]***	[0.188]	[0.185]	[0.224]
R^2	0.59	0.59	0.64	0.01	0.63	0.74
N	274	274	274	161	161	160
Pair FE	No	Yes	Yes	No	Yes	Yes
Coder FE	No	Yes	Yes	No	Yes	Yes
Subject	No	Yes	Yes	No	Yes	Yes
Class designation	No	No	Yes	No	No	Yes
School location	No	No	Yes	No	No	Yes
Teacher charact	No	No	Yes	No	No	Yes
Student charact	No	No	Yes	No	No	Yes

* p<0.1; ** p<0.05; *** p<0.01

Notes: N refers to classes. Standard errors are clustered at the school level. Source: The 2021 survey was conducted among 159 fifth-grade teachers in 176 Rio de Janeiro municipal network classes in November and December 2021. The 2019 survey was conducted in November 2019.

The last three columns of Table 4 indicate that the positive effect of the in-person intervention disappears for the online version. The null effect of the online intervention on the TEACH indicator is robust to the inclusion of controls—we find results with p-values> .10 in all estimated models of the online version of the treatment.

Table 5 unravels the estimated effects presented in Table 4 across the TEACH three main areas (classroom culture, instruction, and socio-emotional skills). As shown in columns [1] and [3] of Table 5, which presents the model with all control variables, the change in the overall quality of teaching practices from the in-person intervention came mainly from changes in classroom culture – whether the teacher is promoting a supportive learning environment and presents positive behavioral expectations towards the students – and in instruction – indicating the quality of lesson facilitation, if the teacher checks the understanding and gives feedback to students, and whether the teacher promotes critical thinking in the classroom. As shown in columns [2] and [4] of Table 5, we find none of these effects for the online intervention – all the estimated coefficients have p-values greater than ten percent.

Table 5: Treatment effect on TEACH three main areas

	Classroom culture		Instruction		Socioemotional skills	
	2019 In-person	2021 Online	2019 In-person	2021 Online	2019 In-person	2021 Online
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment school	0.518	-0.115	0.387	0.079	0.195	-0.078
	[0.089]***	[0.187]	[0.136]***	[0.219]	[0.134]	[0.247]
R^2	0.65	0.69	0.57	0.74	0.61	0.66
N	274	160	274	160	274	160
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes	Yes	Yes
Subject	Yes	Yes	Yes	Yes	Yes	Yes
Class designation	Yes	Yes	Yes	Yes	Yes	Yes
School location	Yes	Yes	Yes	Yes	Yes	Yes
Teacher charact	Yes	Yes	Yes	Yes	Yes	Yes
Student charact	Yes	Yes	Yes	Yes	Yes	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Notes: N refers to classes. Standard errors are clustered at the school level. Source: The 2021 survey was conducted among 159 fifth-grade teachers in 176 Rio de Janeiro municipal network classes in November and December 2021. The 2019 survey was conducted in November 2019.

We find no significant improvement in promoting socioemotional skills for both the in-person and online versions of the workshop. While it is surprising that a greater growth mindset from the 2019 intervention is not associated with promoting socioemotional skills, the online intervention is equally incapable of affecting such an indicator of teaching practices.

5.2.b. Use of Time in the Classroom

We then analyze the effects of our in-person and online interventions on the teacher's use of time in the classroom, measured by the classroom observation “snapshots” conducted by external coders trained in the TEACH+ methodology. Tables 6, 7, and 8 present the estimated effects of 2019 in-person and 2021 online interventions on teachers' time on academic activities, classroom management, and being off-task, respectively.

The first three columns of Tables 6, 7, and 8 refer to the treatment effects considering the in-person intervention, and the last three columns refer to the effects considering the online intervention. Columns [1] and [4] of these tables include controls for the moment of the snapshot, pair, and coder fixed effects, as well as the subject the teacher is teaching during the observation. Columns [2] and [5] include additional controls for the class designation and the school location. Columns [3] and [6] refer to the complete models, including teacher and student characteristics.

Table 6: Treatment effect on the time spent by teachers on academic activities

	Academic activities 2019: In-Person			Academic activities 2021: Online		
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment school	0.013	0.005	0.002	0.052	0.083	0.081
	[0.022]	[0.022]	[0.024]	[0.026]**	[0.029]***	[0.028]***
R^2	0.14	0.15	0.15	0.12	0.13	0.15
N	2,740	2,740	2,740	1,610	1,610	1,610
Moment of obs	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes	Yes	Yes
Subject	Yes	Yes	Yes	Yes	Yes	Yes
Class designation	No	Yes	Yes	No	Yes	Yes
School location	No	Yes	Yes	No	Yes	Yes
Teacher charact	No	No	Yes	No	No	Yes
Student charact	No	No	Yes	No	No	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Notes: N refers to observations (10 times for each classroom). Standard errors are clustered at the classroom level. Source: The 2021 survey was conducted among 159 fifth-grade teachers in 176 Rio de Janeiro municipal network classes in November and December 2021. The 2019 survey was conducted in November 2019.

Table 7: Treatment effect on the time spent by teachers on classroom management

	Classroom management 2019: In-Person			Classroom management 2021: Online		
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment school	-0.023	-0.020	-0.000	-0.053	-0.079	-0.085
	[0.019]	[0.020]	[0.021]	[0.020]***	[0.024]***	[0.024]***
R^2	0.10	0.11	0.12	0.09	0.11	0.12
N	2,740	2,740	2,740	1,610	1,610	1,610
Moment of obs	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes	Yes	Yes
Subject	Yes	Yes	Yes	Yes	Yes	Yes
Class designation	No	Yes	Yes	No	Yes	Yes
School location	No	Yes	Yes	No	Yes	Yes
Teacher charact	No	No	Yes	No	No	Yes
Student charact	No	No	Yes	No	No	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Notes: N refers to observations (10 times for each classroom). Standard errors are clustered at the classroom level. Source: The 2021 survey was conducted among 159 fifth-grade teachers in 176 Rio de Janeiro municipal network classes in November and December 2021. The 2019 survey was conducted in November 2019.

Table 8: Treatment effect on the time spent by teachers being off-task

	Teacher Off-task 2019: In-Person			Teacher Off-task 2021: Online		
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment school	0.010	0.012	-0.001	0.001	-0.004	0.003
	[0.016]	[0.017]	[0.017]	[0.013]	[0.014]	[0.015]
R^2	0.10	0.10	0.11	0.08	0.08	0.10
N	2,740	2,740	2,740	1,610	1,610	1,610
Moment of obs	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes	Yes	Yes
Subject	Yes	Yes	Yes	Yes	Yes	Yes
Class designation	No	Yes	Yes	No	Yes	Yes
School location	No	Yes	Yes	No	Yes	Yes
Teacher charact	No	No	Yes	No	No	Yes
Student charact	No	No	Yes	No	No	Yes

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Notes: N refers to observations (10 times for each classroom). Standard errors are clustered at the classroom level. Source: The 2021 survey was conducted among 159 fifth-grade teachers in 176 Rio de Janeiro municipal network classes in November and December 2021. The 2019 survey was conducted in November 2019.

The results shown in Tables 6, 7, and 8 are surprising. While the 2019 in-person intervention did not affect the overall teachers' use of time, the 2021 online intervention has made class time use more efficient by significantly increasing the time spent on academic activities and reducing the time spent on classroom management. Specifically, while columns [1] to [3] of Tables iv and v present effects with p-values greater than .10, columns [4] to [6] of both tables show an increase in academic activities and a decrease in classroom management – $\beta_1 = .081$ (p-value < .01) increase in academic activities and $\beta_1 = -.085$ (p-value < .01) in classroom management, in our preferred models (columns [6]). Table vi shows no significant effects for the time teachers are off-task in both models, meaning that neither the in-person nor the online intervention have affected the time teachers are not engaged with any academic activity or organizing the class.

6. Discussion

Our findings are intriguing. Although our intervention in 2021 did not impact the mindset of teachers or the quality of teaching practices (measured by the TEACH indicator), we did observe significant effects on how teachers allocate their time. This effect was not observed in 2019. Two issues arise from interpreting these results: First, how could our intervention influence the use of time by teachers without changing their beliefs? Secondly, what factors specific to 2021 but absent in 2019 could have affected the use of time by teachers?

For the first issue, we unraveled the indicator of teachers' growth mindsets, measured by the Implicit Theory of Intelligence Scale (ITIS), by analyzing its validity and reliability. 'Validity' refers to the extent to which an indicator measures what it purports to measure. In contrast, 'reliability' refers to the degree to which an assessment tool produces stable and consistent results – referring to the extent to which the tool is free from measurement error. One key aspect of reliability is 'internal consistency,' which measures whether the items are all measuring the same underlying construct. Cronbach's Alpha is a statistic commonly used to assess the internal consistency of a test. A high Cronbach's Alpha value (typically above 0.70) indicates that the items within the survey are highly correlated and thus reliably measure the same concept (Perrot et al., 2018). This internal consistency is crucial for ensuring that the survey results are dependable and reflective of the construct being measured rather than being influenced by random error or unrelated factors.

Considering the Cronbach Alpha of the teachers' growth mindset indicator, we found that two questions were inconsistent with the rest of the adapted ITIS questionnaire in both years. These questions are: (i) "Performing well on a task is a good way for students to show others they are intelligent," and (ii) "Difficulties and challenges prevent students from developing their intelligence." However, when we excluded these two questions from the overall ITIS indicator, the results of the treatments' effect on the growth mindset indicators in 2019 and 2021 remained unchanged.

There were, however, additional questions with low consistency with the ITIS indicator in 2021 but had good consistency in 2019. They are: (i) "The student is born with a fixed amount of intelligence"; (ii) "If a student does poorly on a task, I question their intelligence or aptitude"; (iii) "When a student makes a lot of effort to learn something, he reveals that he is not very intelligent"; (iv) "You continue to think the student is intelligent even when he does poorly on a task"; (v) "Constructive criticism from other people can help students develop their intelligence." If we exclude these questions from the indicator – if we create a growth mindset for teachers in 2021 with only the questions with good consistency – we find significant treatment effects on this new indicator. That means that although the teacher's growth mindset, measured by our primary indicator, was not affected by the online intervention, some aspects of teachers' beliefs were. These changes may explain the observed changes in the classroom use of time in the 2021 intervention.

We then look to the questions that do present significant change after the 2021 intervention to analyze what is being affected by the intervention. They are: (i) Preparing

well before facing a task is a way for students to develop their intelligence; (ii) Performing a task successfully can help the student develop their intelligence; (iii) The student can increase his intelligence if he tries hard; (iv) When the student learns new things, his intelligence level increases; and (v) Exerting effort leads the students to increase their intelligence. When we estimate the treatment effect on an indicator with only these questions, the 2021 online workshop has a positive and significant impact, which is robust to the inclusion of all control variables presented in Equation (1).

When comparing the questions affected by the 2021 intervention with those that were not, it appears that the idea of fixed and growth mindsets was not very well-established among the treated teachers. However, the concept of 'effort' related to the growth mindset was. One possible interpretation of these results is that the online intervention may not effectively change beliefs, but practical concepts are open to change with this type of training. Therefore, it is reasonable to expect insignificant results on the TEACH variables but positive results on the use of time, especially in the post-pandemic context where time in the classroom was precious.

However, the second issue remains: What in 2021 could have affected the teacher's use of time that was not present in 2019? 2021 was a year of returning to presential classes. In fact, Brazil was one of the latest countries in the world to re-open schools (OCDE 2022; Reimers e Schleicher 2021). Therefore, the use of time in the classrooms is not disassociated from the context of the gradual return to in-person classes post-COVID-19 pandemic. During that period, efforts from all sectors of Rio's Municipal Secretariat of Education (SME) were to prioritize children's learning in implementing educational policies.

However, the focus on active efforts to bring students back to school in 2021 neglected aspects related to the teachers. Although there was discussion about the importance of teachers' mental health at the time, continuous professional development initiatives were generally non-existent. Additionally, there was a collective premise regarding the importance of recovering the "lost time" for students. Research on the topic highlighted the importance of bridging learning gaps, as the extent of these gaps was not precisely known (Soares 2022; Koslinski & Bartholo 2021). Consequently, the Secretariat provided numerous pedagogical resources (in printed and digital formats) to enhance learning processes.

Therefore, the sense of urgency to compensate for students' "lost time" may have significantly contributed to the development of effective pedagogical practices that

promote learning. In such cases, excessive time spent on classroom management and situations where teachers take on other duties and spend extended periods away from the proposed student tasks were decreased.

If this perception is accurate, we expect to see an improvement in how teachers allocate their time in both the treatment and control groups in 2021 compared to 2019. Table vii provides a breakdown of the time teachers spent on academic activities, classroom management, and off-task behavior for the entire sample, as well as for the treatment and control groups individually, comparing 2019 with 2021.

Based on Table 9, it is evident that teachers used their time more efficiently in 2021 compared to 2019 across all samples, including the control groups. In 2021, teachers spent 75% of class time on academic activities, 19% on classroom management, and only 6% off-task. In contrast, in 2019, these percentages were 67% on academic activities, 23% on classroom management, and 10% off-task for the control groups. This suggests an overall effort in 2021 to use time more efficiently, supporting our hypothesis that there was a sense of urgency in 2021 affecting teachers' use of time in the classroom, which we attribute to school closures.

Table 9: Teacher's use of time

	Year of Data Collection:	
	2019	2021
All sample	Mean/SD	Mean/SD
Academic activities	0.66	0.77
	(0.47)	(0.42)
Classroom management	0.23	0.17
	(0.42)	(0.37)
Off-task	0.11	0.06
	(0.31)	(0.24)
Number of classes	**274**	**161**
Treatment group		
Academic activities	0.65	0.78
	(0.48)	(0.41)
Classroom management	0.23	0.15
	(0.42)	(0.36)
Off-task	0.12	0.07
	(0.32)	(0.25)
Number of classes	**152**	**81**
Control group		
Academic activities	0.67	0.75
	(0.47)	(0.43)

Classroom management	0.23	0.19
	(0.42)	(0.39)
Off-task	0.10	0.06
	(0.30)	(0.24)
Number of classes	**122**	**80**

Source: The 2021 classroom observations were conducted in Rio de Janeiro municipal network classes between November and December 2021, and the 2019 classroom observations were conducted in November 2019.

If teachers were eager to use their classroom time more efficiently in 2021 but lacked the training to support them in improving their teaching practices, our online workshop could have served as a tool for teachers to achieve this goal. This support given by our online workshop could have come from the changes in their beliefs about the importance of making an effort to improve student learning, which then improved the way they organized their class time.

7. Conclusion

Teacher training programs can be expensive and difficult to implement, leading many education departments to consider online or hybrid methods to improve access. The COVID-19 pandemic has increased interest in online training, highlighting the need to understand its effects more thoroughly. However, online workshops may have drawbacks compared to in-person training, such as weaker connections between participants and facilitators, as well as decreased engagement due to potential distractions. These challenges emphasize the importance of addressing the unique difficulties of online training, especially when analyzing changes in beliefs about intelligence, like a growth mindset.

Our study reveals nuanced insights into the impacts of online versus in-person growth mindset interventions for teachers. We find that the online intervention in 2021 did not have a significant impact on teachers' overall mindsets or the quality of their teaching practices. However, it did influence how teachers managed their classroom time, which was not observed in the 2019 in-person intervention. Our analysis indicates that while teachers' understanding of fixed and growth mindsets did not change significantly after the online intervention, their perception of 'effort' related to a growth mindset was positively affected. This nuance may explain why we observed significant changes in time management but not in other teaching variables, especially in the post-pandemic context where classroom time was particularly valuable.

In fact, the per capita cost of the in-person workshop was significantly higher compared to the online version, with R$2,249 versus R$451 for each trained teacher. The cost components for the in-person workshop included hiring fees for facilitators, who were teacher trainers from the Rio Municipal School Network, academic grants for master's students who supported the workshops and managed data collection and processing, snacks, and public transport vouchers for teachers. There were no costs for space rental, as the Rio District provided rooms for the workshops at no charge. For the remote workshops, the costs included hiring fees for facilitators and junior researchers but did not cover snacks or transportation costs. Despite the higher costs, the in-person workshop had virtually no attrition, whereas, for the online version, only 69 out of the 154 teachers from the randomly selected schools completed four or more days of the workshop. Therefore, our findings indicate that while the in-person workshop was more expensive, it generated significantly higher teacher engagement and better overall results. This indicates that the additional investment in in-person training may be justified by the superior results achieved.

The return to in-person classes in 2021, after prolonged school closures due to the COVID-19 pandemic, created a unique environment that likely influenced these findings. In Brazil, the delayed reopening of schools led to an urgent effort to make up for lost time and bridge learning gaps, with significant resources directed toward enhancing student learning. However, this intense focus on students may have resulted in insufficient continuous teacher training. While the efforts to maximize classroom time were beneficial, they may have overlooked the need for sustained teacher support, which was detrimental to developing a growth mindset.

References

Abd-El-Fattah, S. M., & Yates, G. (2006). Implicit Theory of Intelligence Scale: Testing for factorial invariance and mean structure. *ABD06289*. https://www.aare.edu.au/publications-database.php/4930/implicit-theory-of-intelligence-scale-testing-for-factorial-invariance-and-mean-structure

Blackwell, L., Trzesniewski, K., & Dweck, C. (2007). Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and an Intervention. *Child Development*, *78*(1), 246–263. https://doi.org/10.1111/j.1467-8624.2007.00995.x

Brazil, N. I. of S. and R. A. T. (INEP). (2015). *Saeb* [Dataset]. https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados/saeb

Brazil, N. I. of S. and R. A. T. (INEP). (2016). *Censo Escolar* [Dataset]. https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados/censo-escolar

Brazil, N. I. of S. and R. A. T. (INEP). (2017). *Saeb* [Dataset]. https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados/saeb

Brazil, N. I. of S. and R. A. T. (INEP). (2018). *Censo Escolar* [Dataset]. https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados/censo-escolar

Bruns, B., Costa, L., & Cunha, N. (2018). Through the looking glass: Can classroom observation and coaching improve teacher performance in Brazil? *Economics of Education Review*, *64*, 214–250. https://doi.org/10.1016/j.econedurev.2018.03.003

Bruns, B., & Luque, J. (2014). *Great Teachers: How to Raise Student Learning in Latin America and the Caribbean*. World Bank Publications.

Claro, S. L. (2016). *Beliefs and their role for education quality and equality*. Stanford University. Graduate School of Education.

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, *24*(4), 349–354. https://doi.org/10.1037/h0047358

Cruz, T. (Upcoming). *Do teachers' mindsets affect pedagogical practices? A randomized intervention in a socially vulnerable context*.

Dee, T. S. (2004). Teachers, Race, and Student Achievement in a Randomized Experiment. *The Review of Economics and Statistics*, *86*(1), 195–210. https://doi.org/10.1162/003465304323023750

Dee, T. S. (2005). A Teacher Like Me: Does Race, Ethnicity, or Gender Matter? *American Economic Review*, *95*(2), 158–165. https://doi.org/10.1257/000282805774670446

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random house.

Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit theories and their role in judgments and reactions: A word from two perspectives. *Psychological Inquiry*, *6*(4), 267–285.

Dweck, C. S., & Leggett, E. L. (1988). A Social-Cognitive Approach to Motivation and Personality. *MOTIVATION AND PERSONALITY*, 18.

Dweck, C., & Yeager, D. (2021). Global Mindset Initiative Introduction: Envisioning the Future of Growth Mindset Research in Education. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3911564

Good, C., Aronson, J., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Journal of Applied Developmental Psychology*, *24*(6), 645–662. https://doi.org/10.1016/j.appdev.2003.09.002

Handa, K., Clapper, M., Boyle, J., Wang, R. E., Yang, D., Yeager, D. S., & Demszky, D. (2023). *"Mistakes Help Us Grow": Facilitating and Evaluating Growth Mindset Supportive Language in Classrooms* (arXiv:2310.10637). arXiv. http://arxiv.org/abs/2310.10637

Hecht, C., Murphy, M., Dweck, C., Bryan, C., Trzesniewski, K., Medrano, F., Giani, M., Mhatre, P., & Yeager, D. (2023). Shifting the Mindset Culture to Address Global Educational Disparities Content type: Perspective. *Npj Science of Learning*.

Molina, E., Fatima, S. F., Ho, A., Hurtado, C. M., & Pushparatnam, A. (2018). Measuring Teaching Practices at Scale: Results from the Development and Validation of the Teach Classroom Observation Tool. *Policy Research Working Paper*, *8653*, 38.

Molina, E., Pushparatnam, A., Rimm-Kaufman, S., & Wong, K. K.-Y. (2018). Evidence based teaching: Effective teaching practices in primary school classrooms. *The World Bank*, 65. https://doi.org/10.1596/1813-9450-8656

Paunesku, D., Walton, G. M., Romero, C., Smith, E. N., Yeager, D. S., & Dweck, C. S. (2015). Mind-Set Interventions Are a Scalable Treatment for Academic Underachievement. *Psychological Science*, *26*(6), 784–793. https://doi.org/10.1177/0956797615571017

Perrot, B., Bataille, E., & Hardouin, J.-B. (2018). validscale: A Command to Validate Measurement Scales. *The Stata Journal*, *18*(1), 29–50. https://doi.org/10.1177/1536867X1801800104

Rattan, A., Good, C., & Dweck, C. S. (2012). "It's ok — Not everyone can be good at math": Instructors with an entity theory comfort (and demotivate) students. *Journal of*

Experimental Social Psychology, *48*(3), 731–737. https://doi.org/10.1016/j.jesp.2011.12.012

Reynolds, W. M. (1982). Development of reliable and valid short forms of the marlowe-crowne social desirability scale. *Journal of Clinical Psychology*, *38*(1), 119–125. https://doi.org/10.1002/1097-4679(198201)38:1<119::AID-JCLP2270380118>3.0.CO;2-I

Rubie-Davies, C. M., Peterson, E. R., Sibley, C. G., & Rosenthal, R. (2015). A teacher expectation intervention: Modelling the practices of high expectation teachers. *Contemporary Educational Psychology*, *40*, 72–85. https://doi.org/10.1016/j.cedpsych.2014.03.003

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology*, *69*, 797–811. https://doi.org/10.1037/0022-3514.69.5.797

Yeager, D., & Dweck, C. (2020). What Can Be Learned From Growth Mindset Controversies? *American Psychologist*, *75*, 1269–1284. https://doi.org/10.1037/amp0000794

Yeager, D. S., Hanselman, P., Walton, G. M., Murray, J. S., Crosnoe, R., Muller, C., Tipton, E., Schneider, B., Hulleman, C. S., Hinojosa, C. P., Paunesku, D., Romero, C., Flint, K., Roberts, A., Trott, J., Iachan, R., Buontempo, J., Yang, S. M., Carvalho, C. M., … Dweck, C. S. (2019). A national experiment reveals where a growth mindset improves achievement. *Nature*, *573*(7774), Article 7774. https://doi.org/10.1038/s41586-019-1466-y

Yeager, D. S., Romero, C., Paunesku, D., Hulleman, C. S., Schneider, B., Hinojosa, C., Lee, H. Y., O'Brien, J., Flint, K., Roberts, A., Trott, J., Greene, D., Walton, G. M., & Dweck, C. S. (2016). Using design thinking to improve psychological interventions: The case of the growth mindset during the transition to high school. *Journal of Educational Psychology*, *108*(3), 374–391. https://doi.org/10.1037/edu0000098