

Teacher Mindsets and Student Learning: A Randomized Intervention in Rio de Janeiro

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Motivation

- A 'growth mindset' is the belief that abilities can grow (Dweck and Yeager 2019).
- The literature is well-established in showing the impact of **student mindset interventions** on their **school achievement** (Blackwell et al., 2007; Yeager et al. 2019).
- There is a growing body of research showing the importance of **teacher mindsets** to sustain student growth mindsets (Yeager et al., 2022; OECD, 2021).
- However, little is known about:
 - Effective interventions to improve teachers' mindset.
 - The effects of teachers' growth mindset on pedagogical practices and student learning.
- The literature is also scarce on the impact of mindset interventions in contexts of social vulnerability.

Research questions

- ① What is the effect of a teacher mindset intervention on teachers' growth mindset?
 - Did our mindset intervention affect teachers' mindsets?
- ② How does a teacher's growth mindset impact student outcomes?
 - Did our intervention improve student outcomes in Mathematics and Language?
 - Did the increase in teacher growth mindset due to our intervention improve student outcomes in Mathematics and Language?

Results

- Results indicate robust evidence that teachers can change their mindset even in a socially vulnerable context.
- Teachers' growth mindset has a positive and significant effect on student learning.
 - Higher impact on student results in Mathematics.

Randomized Controlled Trial: Intervention

Mindset workshops for 5th-grade teachers in Rio de Janeiro public schools:

- Five two-hour meetings: March and April 2019
- 125 teachers in 8 classes: 2 teacher trainers (1 per class)
- Pilot in 2018: Focal groups; Questionnaires

Content: How to develop a growth mindset classroom

- Fixed and Growth mindset; The brain as a muscle; Dealing with mistakes and frustration; Mindset "trap"; Stereotype threats; Creating a safe learning environment
- Homework: Activities with their students and exchange of experiences among teachers

Randomized Controlled Trial: Intervention



Randomized Controlled Trial: Sample

- 395 schools invited.
 - Schools with 1 or 2 5th grade classrooms (both teachers have agreed to participate).
- 252 schools came to meeting.
- 178 enrolled to participate = 324 5th grade teachers.
 - 50 percent treatment = 89 schools
 - 50 percent treatment = 89 schools
- 152 schools with complete data: 26 schools did not allow classroom observations and/or questionnaire application.
- 273 teachers answered questionnaires; 271 classroom observations.

AEA RCT Registry.

Randomized Controlled Trial: Sample

TABLE 1: EXTERNAL VALIDITY – SCHOOL CHARACTERISTICS

School characteristics	Sample schools	Other 5 th grade schools in Rio	Diff
Portuguese Language 5th grade mean performance (2017)	216.65	214.81	1.85
Mathematics 5th grade mean performance (2017)	227.74	224.95	2.79**
Socioeconomic Level Index (2017)	3.39	3.42	-0.03
5 th grade enrollments	55.87	84.00	-28.13***
Age-grade distortion rate	22.67	21.67	1.00
% male students	52.22	52.14	0.08
% black students	10.91	10.21	0.70
% students whose mother has completed higher education	13.73	13.21	0.52
% students who work	12.75	12.25	-0.50
% black teachers	4.37	3.97	0.40
% teachers with Master's degree	6.00	4.95	1.05
% teachers who teach at more than one school	20.82	21.98	-1.16
% of schools with a library	65.17	68.79	-3.62
% of schools with a science lab	8.99	10.68	-1.69
% of school with internet access for student use	23.60	25.46	-1.87

Notes: N_{Sample schools} = 178 and N_{Other 5th grade schools in Rio} = 487.

Source: School Census 2019; SAEB 2017 (Student performance results); INSE 2017 (Socioeconomic Level Index); (INEP n.d.)

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

Randomized Controlled Trial: Sample

TABLE 2: ATTRITION ANALYSIS

School characteristics	Schools with complete information	Other schools from the sample	Diff
Portuguese Language 5 th grade mean performance (2017)	217.00	215.58	-1.42
Mathematics 5 th grade mean performance (2017)	227.85	227.87	0.02
Socioeconomic Level Index (2017)	3.39	3.44	0.05
5 th grade enrollments	56.74	50.81	-5.93
Age-grade distortion rate	22.74	22.28	-0.46
% male students	52.01	53.46	1.45
% black students	10.66	12.37	1.70
% students whose mother has completed higher education	14.30	10.43	-3.87***
% students who work	12.92	11.76	-1.16
% black teachers	4.32	4.65	0.32
% teachers with Master's degree	5.72	7.64	1.92
% teachers who teach at more than one school	22.09	13.60	-8.49
% of schools with a library	67.11	53.85	-13.26
% of schools with a science lab	9.21	7.69	-1.52
% of school with internet access for student use	23.68	23.08	-0.61

Notes: $N_{\text{Sample schools}} = 178$, where $N_{\text{Schools with complete information}} = 152$ and $N_{\text{Other schools from the sample}} = 26$.

Source: School Census 2019; SAEB 2017 (Student performance results); INSE 2017 (Socioeconomic Level Index); (INEP n.d.)

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

Pairwise Randomized Controlled Trial

- Pairing of predicted value of standardized Math results in 2019 from the standardized test results and students characteristics from previous years.

TABLE 3: SCHOOL COMPARISONS BY TREATMENT STATUS

School characteristics	Treatment	Control	Diff
Portuguese Language 5 th grade mean performance (2017)	228.12	227.53	0.59
Mathematics 5 th grade mean performance (2017)	216.62	217.44	-0.82
Socioeconomic Level Index (2017)	3.41	3.37	0.04
5 th grade enrollments	59.22	62.95	-3.74
Age-grade distortion rate	21.70	23.64	-1.94
% male students	52.99	51.45	1.54
% black students	11.42	10.40	1.02
% students whose mother has completed higher education	14.68	12.79	1.89*
% students who work	12.89	12.61	0.28
% black teachers	5.11	3.62	1.49
% teachers with Master's degree	6.55	5.44	1.11
% teachers who teach at more than one school	21.93	19.74	2.18
% of schools with a library	65.17	65.17	0.00
% of schools with a science lab	10.11	7.87	2.25
% of school with internet access for student use	29.21	17.98	11.24*

Notes: $N_{\text{Treatment}} = N_{\text{Control}} = 89$.

Source: School Census 2019; SAEB 2017 (Student performance results); INSE 2017 (Socioeconomic Level Index); (INEP n.d.)

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

Data Collection: Instruments

Teachers' questionnaires:

- **Mindset:** Implicit Theory of Intelligence (Dweck 2000); Implicit Theory of Intelligence Scale (ITIS) (Abd-El-Fattah and Yates, 2006); Confidence in One's Intelligence (Dweck, 2000).
- **Social desirability:** Marlowe-Crowne Social Desirability Scale Items (Reynolds, 1982)
 - Translated by two separate translators; Focal groups to discuss language and context; Tested in pilot group.

Student achievement:

- **SAEB 2019**

1 month of data collection: Oct 29 to Nov 29/2019

Estimations: Teachers' Growth Mindset

- ① What is the effect of a teacher mindset intervention on teachers' growth mindset?
 - Did our mindset intervention affect teachers' mindsets?

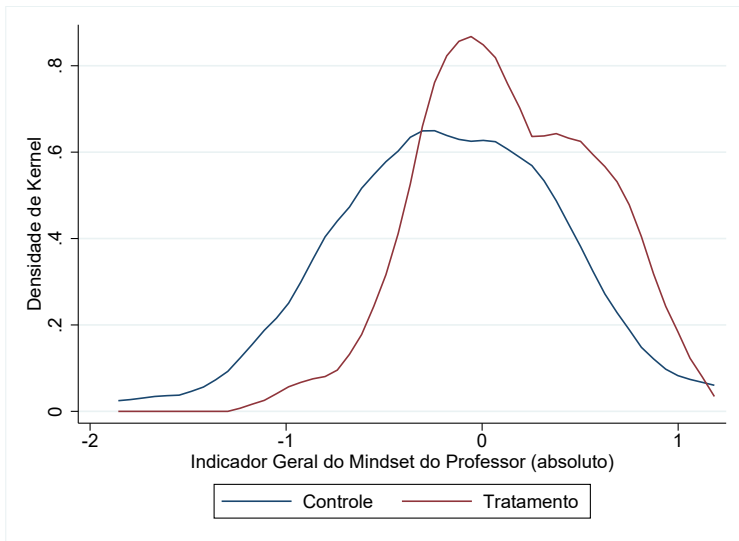
Estimations: Teachers' Growth Mindset

- ① What is the effect of a teacher mindset intervention on teachers' growth mindset?
 - Did our mindset intervention affect teachers' mindsets?

$$\begin{aligned} \text{Teachers Growth Mindset}_{jk} = & \beta_0 + \beta_1 \text{Treatmentschool}_k \\ & + \beta_2 \text{SocialDesirability}_{lk} + \beta_3 \text{PairFE}_k + \beta_4 \text{CoderFE}_k \\ & + \beta_5 \text{Teachercharacter}_{jk} + \beta_6 \text{Schoolsize}_k + \beta_7 \text{Studentcharacter}_{jk} + \epsilon_{jk} \end{aligned}$$

where j refers to classes and k to schools.

Estimations: Teachers' Growth Mindset



Results: Teachers' Growth Mindset

TABLE 4: TREATMENT EFFECTS ON TEACHER GROWTH MINDSET

	[1]	[2]	[3]	[4]
	Teacher's Growth Mindset			
Treatment school	0.516	0.515	0.571	0.606
	[0.122]***	[0.121]***	[0.132]***	[0.140]***
R^2	0.48	0.49	0.56	0.58
N	273	273	273	273
Pair FE	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes
Social desirability	Yes	Yes	Yes	Yes
School size	No	Yes	Yes	Yes
Teacher characteristics	No	No	Yes	Yes
Student characteristics	No	No	No	Yes

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

Sources: Data collected in Nov/2019. Standard errors clustered at school level. Questions are adapted from Implicit Theory of Intelligence (Dweck 2000); Implicit Theory of Intelligence Scale (ITIS) (Abd-El-Fattah and Abd-El-Fattah, 2006); Confidence in One's Intelligence (Dweck, 2000).

Estimations: Student achievement

- ① What is the effect of a teacher mindset intervention on teachers' growth mindset?
 - Did our mindset intervention affect teachers' mindsets?
- ② How does a teacher's growth mindset impact student outcomes?
 - Did our intervention improve student outcomes in Mathematics and Language?
 - Did the increase in teacher growth mindset due to our intervention improve student outcomes in Mathematics and Language?

Estimations: Student achievement

- ① What is the effect of a teacher mindset intervention on teachers' growth mindset?
 - Did our mindset intervention affect teachers' mindsets?
- ② How does a teacher's growth mindset impact student outcomes?
 - **Did our intervention improve student outcomes in Mathematics and Language?**
 - Did the increase in teacher growth mindset due to our intervention improve student outcomes in Mathematics and Language?

Results: Student achievement

TABLE 5: STUDENT RESULTS - TREATMENT EFFECTS ON MATHEMATICS

	[1]	[2]	[3]	[4]
Math Test Scores				
Treatment school	0.245 [0.116]**	0.263 [0.115]**	0.361 [0.099]***	0.322 [0.097]***
R^2	0.64	0.65	0.68	0.71
N	7,055	7,055	7,055	6,969
Pair FE	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes
School size	No	Yes	Yes	Yes
Teacher characteristics	No	No	Yes	Yes
Student characteristics	No	No	No	Yes

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

Sources: Data collected in Nov/2019. Standardized test scores from SAEB/INEP, Brazilian Ministry of Education.

Results: Student achievement

TABLE 6: STUDENT RESULTS - TREATMENT EFFECTS ON LANGUAGE

	[1]	[2]	[3]	[4]
Language Test Scores				
Treatment school	0.187 [0.102]*	0.198 [0.104]*	0.187 [0.090]**	0.127 [0.078]
R^2	0.59	0.60	0.62	0.66
N	7,055	7,055	7,055	6,969
Pair FE	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes
School size	No	Yes	Yes	Yes
Teacher characteristics	No	No	Yes	Yes
Student characteristics	No	No	No	Yes

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

Sources: Data collected in Nov/2019. Standardized test scores from SAEB/INEP, Brazilian Ministry of Education.

Estimations: Student achievement

- ① What is the effect of a teacher mindset intervention on teachers' growth mindset?
 - Did our mindset intervention affect teachers' mindsets?
- ② How does a teacher's growth mindset impact student outcomes?
 - Did our intervention improve student outcomes in Mathematics and Language?
 - **Did the increase in teacher growth mindset due to our intervention improve student outcomes in Mathematics and Language?**

Estimations: IV Student achievement

First-stage:

$$\begin{aligned} TeachersGrowthMindset_k = & \beta_0 + \beta_1 Treatmentschool_k \\ & + \beta_2 PairFE_k + \beta_3 CoderFE_k + \beta_4 SubjFE_k \\ & + \beta_5 Teachercharacter_k + \beta_6 Schoolsize_k + \beta_7 Studentcharacter_{ik} + \epsilon_k \end{aligned}$$

Second-stage:

$$\begin{aligned} SAEB2019_{ik} = & \beta_0 + \beta_1 Teachers \widehat{Growth Mindset}_k \\ & + \beta_2 PairFE_k + \beta_3 CoderFE_k + \beta_4 SubjFE_k \\ & + \beta_5 Teachercharacter_k + \beta_6 Schoolsize_k + \beta_7 Studentcharacter_{ik} + \epsilon_{ik} \end{aligned}$$

where i refers to students and k to schools.

Results: IV Student achievement

TABLE 7: STUDENT RESULTS – GROWTH MINDSET EFFECTS ON MATHEMATICS

	[1]	[2]	[3]	[4]
First-stage	Teacher's Growth Mindset			
Treatment school	0.367 [0.009]***	0.369 [0.009]***	0.311 [0.010]***	0.364 [0.010]***
Second-stage	Math Test Scores			
Teacher's Growth Mindset	0.266 [0.077]***	0.266 [0.077]***	0.262 [0.084]***	0.156 [0.076]**
<i>N</i>	7,055	7,055	7,055	6,969
Pair FE	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes
Social desirability	Yes	Yes	Yes	Yes
School size	No	Yes	Yes	Yes
Teacher characteristics	No	No	Yes	Yes
Student characteristics	No	No	No	Yes

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

Sources: Data collected in Nov/2019. Standardized test scores from SAEB/INEP, Brazilian Ministry of Education. Questions are adapted from Implicit Theory of Intelligence (Dweck 2000); Implicit Theory of Intelligence Scale (ITIS) (Abd-El-Fattah and Yates, 2006); Confidence in One's Intelligence (Dweck, 2000).

Results: IV Student achievement

TABLE 8: STUDENT RESULTS – GROWTH MINDSET EFFECTS ON LANGUAGE

	[1]	[2]	[3]	[4]
First-stage	Teacher's Growth Mindset			
Treatment school	0.367 [0.009]***	0.369 [0.009]***	0.311 [0.010]***	0.364 [0.010]***
Second-stage	Language Test Scores			
Teacher's Growth Mindset	0.206 [0.083]**	0.206 [0.083]**	0.193 [0.091]**	0.096 [0.082]
<i>N</i>	7,055	7,055	7,055	6,969
Pair FE	Yes	Yes	Yes	Yes
Coder FE	Yes	Yes	Yes	Yes
Social desirability	Yes	Yes	Yes	Yes
School size	No	Yes	Yes	Yes
Teacher characteristics	No	No	Yes	Yes
Student characteristics	No	No	No	Yes

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

Sources: Data collected in Nov/2019. Standardized test scores from SAEB/INEP, Brazilian Ministry of Education. Questions are adapted from Implicit Theory of Intelligence (Dweck 2000); Implicit Theory of Intelligence Scale (ITIS) (Abd-El-Fattah and Yates, 2006); Confidence in One's Intelligence (Dweck, 2000).

Conclusion

- Results indicate robust evidence that teachers had increased growth mindset after participating in workshops.
- Students in classes where teachers participated in growth mindset workshops had a significant improvement in Math test scores (0.3 sd), but no significant change in Language scores.
- Students whose teachers have higher growth mindset had a significant increase in Math test scores, but also no significant change in Language scores.
- There is evidence that the one of the possible mechanisms to explain such significant changes in learning is the observed improvement in pedagogical practices, particularly in classroom culture and quality of instruction (measured by TEACH+ methodology).

Looking forward

- In 2021, we did a follow-up intervention with the following goals:
 - 1 Evaluate the long-term effects of the mindset.
 - 2 Evaluate different formats of delivering the workshop: online and synchronous format, allowing easier expansion to the school network.
 - 3 Focus the content of the workshops to improving racial equity in educational outcomes.

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