Implicit Stereotypes:
Evidence from Teachers' Gender Bias
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Michela Carlana

Presentation by: Alireza Tavakoli

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Literature Review

- There is a long-standing debate on whether the gender gap in math achievement arises from biologically based differences in brain functioning as opposed to culture and social conditioning.

- Cross-country evidence supports the latter idea: cultures in which gender stereotypes are weaker have a smaller gender gap in math performance.

- Teachers are likely to believe math is more difficult for girls than for equally achieving boys and they implicitly convey their stereotyping through their classroom instruction.

Literature Review

- Chetty et al.(2014, *AER*) Teachers matter for students performance and later-life outcomes and their gender stereotypes may be an important channel.

- Alan et al.(2018, *REStud*) Analyzing the impact of teacher gender stereotypes on student outcomes by self-reported measures.

- Lavy and Sand (2018, *JPE*) Bias in grading, that is, the gender differences in grades given in blind versus open evaluations.

Contribution

This article documents the impact of exposure to teacher stereotypes during middle school on student outcomes, including standardized test scores in math and reading, choice of the field of study, and self-confidence.

Data

1. A survey of around 1,400 math and literature teachers conducted from October 2016 to March 2017.

2. Administrative information from the Italian Ministry of Education

3. Student survey data

What Is IAT?

- ▶ How does it measure stereotypes?
- ▶ It does not suffer from social desirability bias, which may be an issue in self-reported measures.
- ▶ Stereotypes are measured without relying on student performance, which may capture variation in unobservable characteristics of pupils potentially correlated with future outcomes.
- ▶ IAT scores are a noisy measure of implicit stereotypes that may be affected by culture and socialization.

Teachers Implicit Gender Bias (IAT Measure)

Math Teacher — Female 430 obs, Male 104 obs.

Literature Teacher — Female 745 obs, Male 99 obs.
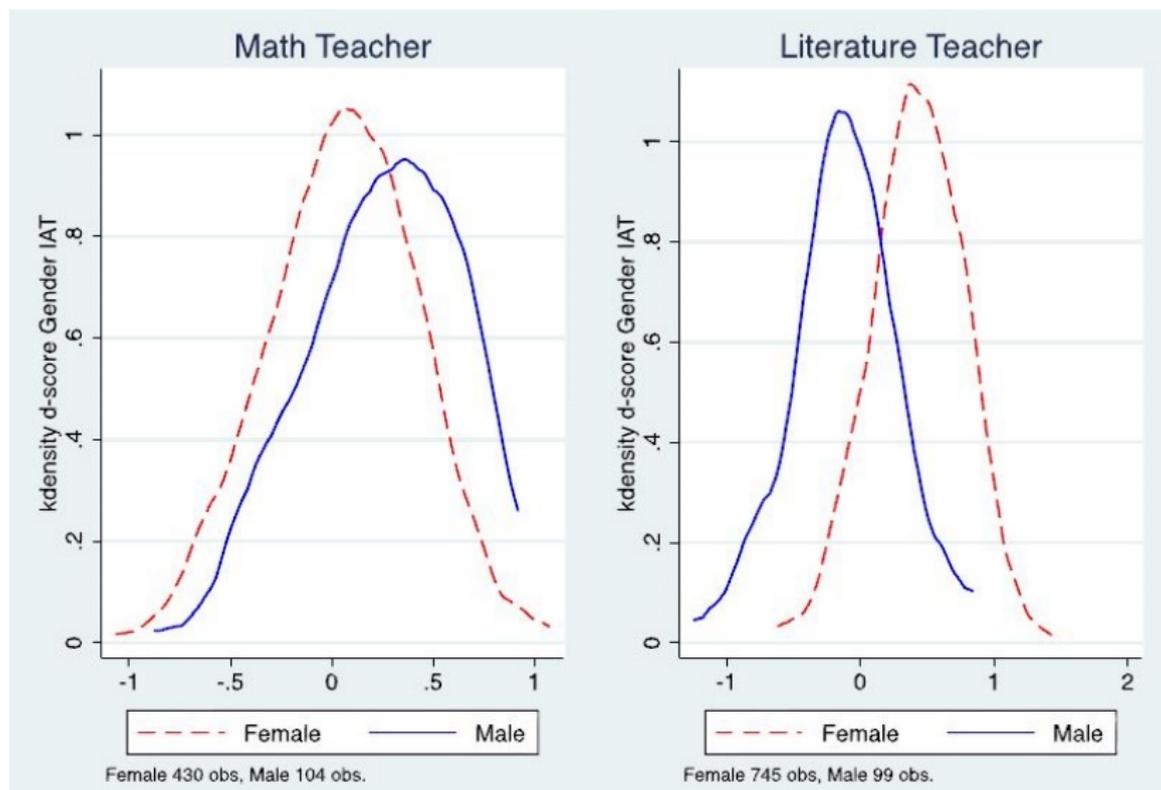
Correlation Between Teachers' Characteristics and IAT

Dep. var.: raw IAT

Panel A: Independent variables (background teachers' characteristics)

	Female	Age	High Mother Edu	Children	Daughters
	(1)	(2)	(3)	(4)	(5)
	-0.174^{***}	-0.015	0.011	-0.072	0.035
	(0.051)	(0.020)	(0.035)	(0.105)	(0.047)
Obs.	454	454	454	454	454
R^2	0.043	0.014	0.011	0.011	0.012

Panel B: Independent variables (cultural traits and beliefs)

	Born North	Women LFP	WVS City Born	WVS Indiv	Innate Ability
	(1)	(2)	(3)	(4)	(5)
	-0.081^{**}	-0.295^{**}	0.307^{***}	-0.003	-0.028
	(0.035)	(0.146)	(0.110)	(0.047)	(0.046)
Obs.	454	433	389	454	454
R^2	0.022	0.021	0.022	0.011	0.011

Panel C: Independent variables (education and teacher experience)

	STEM	Laude	Full Contract	Olympiad	High Exp
	(1)	(2)	(3)	(4)	(5)
	-0.060	-0.082^{**}	-0.075	0.067	-0.016
	(0.045)	(0.039)	(0.053)	(0.069)	(0.063)
Obs.	454	454	454	454	454
R^2	0.016	0.019	0.019	0.200	0.017

First Identification

Investigating the gender gap within a class, estimating the following equation:

$$y_{ic} = \alpha_0 + \alpha_1 \left(\text{Female}_i \times \text{stereotypes}_c\right) + \alpha_2 \text{Female}_i + \eta_c + \\ + \mathbf{X}_i \rho_1 + \left(\text{Female}_i \times \mathbf{X}_i\right) \rho_2 + \left(\text{Female}_i \times \mathbf{Z}_c\right) \rho_3 + \epsilon_{ic} \tag{1}$$

The coefficient of interest, α_1, measures how the gender gap in the class is affected by the assignment to teachers with one standard deviation higher stereotypes.

Second Identification

It relies on the comparison of students of the same gender enrolled in the same school, but assigned to teachers with different stereotypes:

$$
\begin{aligned}
y_{icsy} =& \beta_0 + \beta_1 \left(\text{Female}_i \times \text{stereotypes}_c\right) + \beta_2 \text{Female}_i \\
&+ \beta_3 \text{stereotypes}_c + \eta_{sy} + \mathbf{X}_i \rho_1 + \left(\text{Female}_i \times \mathbf{X}_i\right) \rho_2 \quad (2) \\
&+ \mathbf{Z}_c \rho_3 + \left(\text{Female}_i \times \mathbf{Z}_c\right) \rho_4 + \epsilon_{icsy}
\end{aligned}
$$

The advantage with respect to first specification is that we can analyze the effect of teacher stereotypes separately on male students (β_3) and on female students ($\beta_1 + \beta_3$).

Exogeneity Assumption
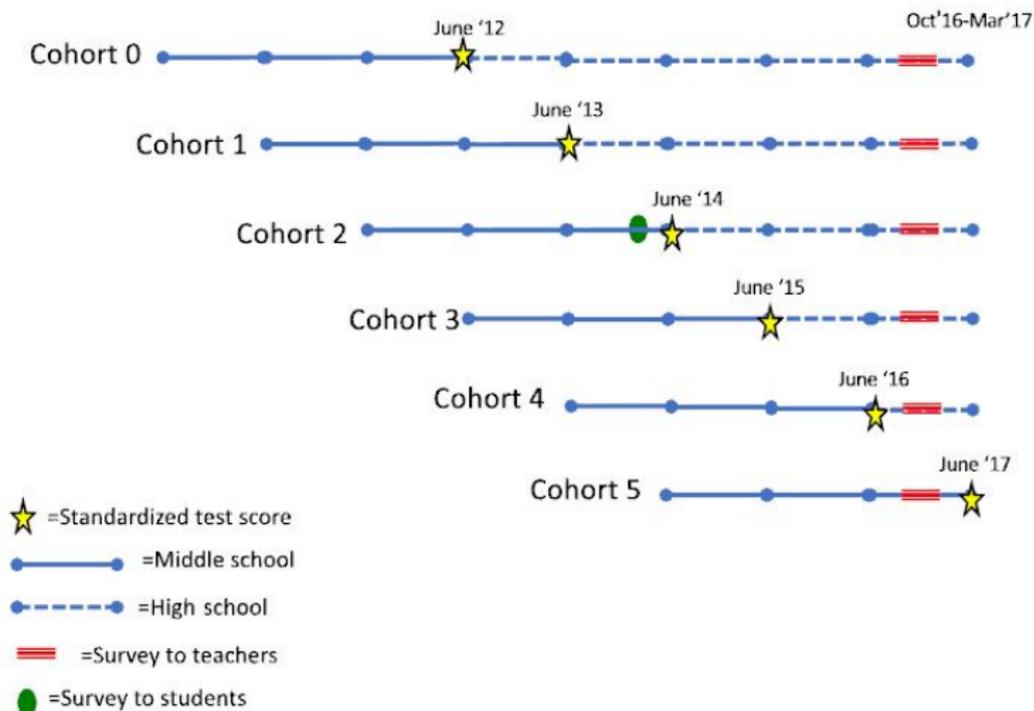
Effect of Teachers' Gender Stereotypes on Math Score

	(1)	(2)	(3)	(4)	(5)
Panel A: Dependent variable: math standardized test score in grade 8					
Female	-0.184^{***}	-0.198^{***}	-0.198^{***}	-0.174^{***}	-0.032
	(0.012)	(0.013)	(0.012)	(0.025)	(0.082)
Fem * Math teacher stereotypes		-0.032^{**}	-0.031^{***}	-0.032^{***}	-0.031^{***}
		(0.013)	(0.012)	(0.012)	(0.011)
Fem * Teacher fem					0.020
					(0.030)
Fem * Teacher born north					0.010
					(0.024)
Fem * Advanced STEM teacher					-0.006
					(0.024)
Gender gap	-0.185	-0.185	-0.186	-0.186	-0.1856
Obs.	30,359	30,359	30,359	30,359	30,359
R^2	0.206	0.206	0.275	0.275	0.276

Effect of Teachers' Gender Stereotypes on Reading Score

	(1)	(2)	(3)	(4)	(5)
Panel B: Dependent variable: reading standardized test score in grade 8					
Female	0.221^{***}	0.225^{***}	0.221^{***}	0.226^{***}	0.307^{***}
	(0.012)	(0.013)	(0.012)	(0.024)	(0.093)
Fem * Lit teacher stereotypes		-0.012	-0.006	-0.007	-0.001
		(0.013)	(0.012)	(0.012)	(0.013)
Fem * Teacher fem					-0.044
					(0.039)
Fem * Teacher born north					0.011
					(0.027)
Gender gap	0.221	0.221	0.219	0.219	0.219
Obs.	29,486	29,486	29,486	29,486	29,486
R^2	0.181	0.181	0.291	0.291	0.291
Class FE	Yes	Yes	Yes	Yes	Yes
Student controls	No	No	Yes	Yes	Yes
Student controls * Fem	No	No	No	Yes	Yes
Teacher controls * Fem	No	No	No	No	Yes

Effect of Teacher Bias on Student Math Performance by Gender
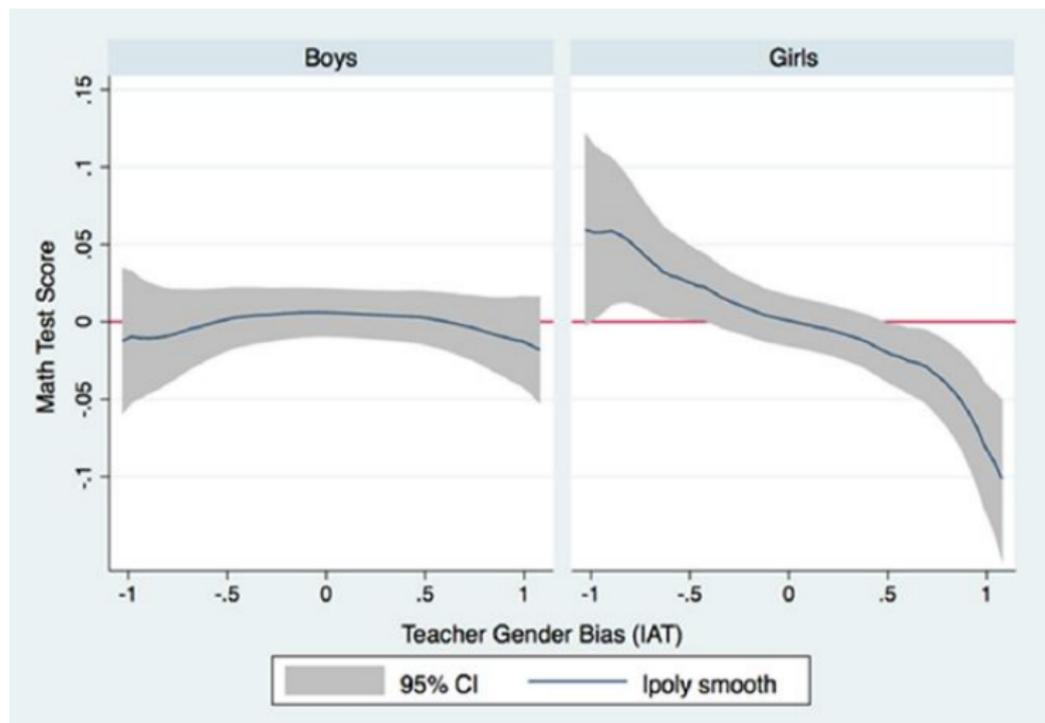
Effect of Teacher Bias on Student Math Performance by Gender

	(1)	(2)	(3)	(4)	(5)
Dependent variable: math standardized test score in grade 8					
Female	−0.180***	−0.192***	−0.196***	−0.166***	−0.047
	(0.012)	(0.013)	(0.012)	(0.024)	(0.079)
Fem * teacher stereotypes		−0.029**	−0.029**	−0.031***	−0.030***
		(0.012)	(0.011)	(0.011)	(0.011)
Teacher stereotypes		−0.018	−0.015	−0.014	−0.013
		(0.013)	(0.012)	(0.012)	(0.012)
Teacher fem					0.066**
					(0.033)
Fem * teacher fem					0.018
					(0.030)
Teacher born north					−0.006
					(0.025)
Fem * teacher born north					0.012
					(0.023)
Advanced STEM					−0.048*
					(0.027)
Fem * advanced STEM teacher					−0.006
					(0.024)

Effect of Teachers' Gender Stereotypes on High School Track Choice

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Dependent variable: vocational high school track choice								
Fem	0.012**	0.020***	0.019***	0.054	0.038	0.028	0.026***	0.011*
	(0.006)	(0.007)	(0.006)	(0.047)	(0.047)	(0.045)	(0.010)	(0.006)
Fem * math teacher stereotypes		0.019***	0.016**	0.013**	0.008	0.004	0.023**	
		(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.009)	
Fem * lit teacher stereotypes							0.009	−0.001
							(0.009)	(0.006)
Constant	0.163***	0.163***	0.190***	0.162***	0.180***	0.159***	0.153***	0.160***
	(0.003)	(0.003)	(0.008)	(0.010)	(0.010)	(0.010)	(0.004)	(0.003)
Mean Y fem	0.175	0.175	0.202	0.202	0.202	0.202	0.172	0.171
Obs.	21,015	21,015	21,015	21,015	19,506	19,506	11,302	20,254
R^2	0.116	0.117	0.161	0.164	0.154	0.220	0.116	0.116

Effect of Teachers' Gender Stereotypes on High School Track Choice

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel B: Dependent variable: scientific high school track choice								
Fem	-0.089^{***}	-0.093^{***}	-0.091^{***}	-0.003	-0.012	-0.006	-0.107^{***}	-0.092^{***}
	(0.007)	(0.008)	(0.008)	(0.051)	(0.054)	(0.051)	(0.012)	(0.008)
Fem * math teacher stereotypes		-0.009	-0.006	-0.008	-0.008	-0.006	-0.024^{**}	
		(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.010)	
Fem * lit teacher stereotypes							0.002	-0.006
							(0.011)	(0.007)
Constant	0.283^{***}	0.283^{***}	0.196^{***}	0.164^{***}	0.160^{***}	0.122^{***}	0.281^{***}	0.284^{***}
	(0.003)	(0.003)	(0.010)	(0.010)	(0.011)	(0.010)	(0.005)	(0.004)
Mean Y fem	0.194	0.194	0.107	0.107	0.108	0.108	0.185	0.191
Obs.	21,015	21,015	21,015	21,015	19,506	19,506	11,302	20,254
R^2	0.117	0.117	0.152	0.159	0.161	0.273	0.111	0.116
Class FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Student controls	No	No	Yes	Yes	Yes	Yes	No	No
Student controls * fem	No	No	No	Yes	Yes	Yes	No	No
Teacher controls * fem	No	No	No	Yes	Yes	Yes	No	No
Sq. math test 8	No	No	No	No	No	Yes	No	No

Effect of Teachers' Gender Stereotypes on Self-Confidence

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Dependent variable: being good/mediocre at math (versus being bad)								
Female	−0.092***	−0.078***	−0.077***	−0.099	−0.076	0.187	−0.089**	−0.042
	(0.029)	(0.027)	(0.028)	(0.064)	(0.063)	(0.214)	(0.042)	(0.029)
Fem * Math teacher stereotypes		−0.048**	−0.048*	−0.055**	−0.042*	−0.059*	−0.065**	
		(0.024)	(0.025)	(0.025)	(0.024)	(0.032)	(0.030)	
Fem * Lit teacher stereotypes							−0.005	−0.041
							(0.040)	(0.028)
Constant	0.840***	0.838***	0.830***	0.843***	0.868***	0.866***	0.832***	0.838***
	(0.015)	(0.018)	(0.033)	(0.049)	(0.047)	(0.047)	(0.021)	(0.018)
Sq. Std Test score math 6	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sq. Std Test score math 8	No	No	No	No	Yes	Yes	No	No
Obs.	789	789	789	789	789	789	461	717
R^2	0.153	0.258	0.259	0.271	0.313	0.327	0.278	0.269
Panel B: Dependent variable: being good/mediocre at reading (versus being bad)								
Female	0.041*	0.050**	0.048**	0.056	0.051	0.035	0.062***	0.028
	(0.023)	(0.023)	(0.023)	(0.044)	(0.044)	(0.288)	(0.023)	(0.018)
Fem * Math teacher stereotypes		0.028	0.028	0.030	0.032	0.028	0.043**	
		(0.018)	(0.019)	(0.020)	(0.020)	(0.020)	(0.021)	
Fem * Lit teachers stereotypes							−0.047*	−0.033*
							(0.024)	(0.017)
Constant	0.922***	0.914***	0.930***	0.928***	0.943***	0.945***	0.926***	0.934***
	(0.012)	(0.015)	(0.022)	(0.032)	(0.032)	(0.034)	(0.017)	(0.013)
Sq. Test score read 6	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sq. Test score read 8	No	No	No	No	Yes	Yes	No	No
Obs.	705	705	705	705	705	705	418	637
R^2	0.205	0.216	0.219	0.223	0.234	0.251	0.139	0.164

Conclusion

- ▶ Gender gap in math performance is substantially affected by teachers' implicit stereotypes.

- ▶ The effects on reading are asymmetric, and literature teacher stereotypes do not affect the gender gap in reading.

- ▶ Stereotype threat theory

Thanks for your attention!