Teachers' Fixed Mindsets Undermine the Effects of a Growth Mindset Intervention

David Yeager, Jamie M. Carroll, Jenny Buontempo, Molly Kudym, Rob Crosnoe, Chandra Muller, Pratik Mhatre

University of Texas at Austin

Background:

Research has repeatedly found that students' beliefs or mindsets are important aspects of their learning trajectories (Walton & Wilson, 2018). In particular, a growth mindset, or the belief that academic abilities can be developed in response to greater effort and improved learning strategies, helps students cope with difficulty and failure because it suggests that academic struggles are part of the process and not due to a lack of intellectual ability (Dweck & Yeager, 2019). Initial results from randomized, controlled trials of a growth mindset treatment have had promising results; an online growth mindset treatment improves the grades of low-achieving high school students (Yeager et al., 2019; Yeager, Romero, et al., 2016). Such results emerge in part because the growth mindset intervention starts a positive recursive process in which students' learning-oriented behavior feeds into better performance and subsequent motivation, presumably reinforcing the growth mindset belief itself.

However, a critical question about this and other educational interventions is how students' educational contexts may affect the effectiveness of the intervention. Given the recursive process described above, whether students' increased learning behaviors can lead to higher levels of academic performance may depend on how their context responds. Teachers are an integral part of this process because they provide students with opportunities to learn and put the intervention message into practice. Thus, students' outcomes associated with a growth mindset intervention may only improve in educational contexts where teachers' beliefs and practices make the growth mindset seem valid and actionable.

Objective:

In this paper, we examine whether a teacher's mindset moderates the intervention's effectiveness. In particular, we test if the growth mindset intervention improves students' outcomes only when teachers provide an educational context that supports a growth mindset (Walton & Yeager, 2019).

Data:

We use the *National Study of Learning Mindsets* (NSLM), a pre-registered, randomized trial evaluating a growth mindset intervention in a nationally-representative sample of 9th graders attending U.S. public schools. The NSLM includes a comprehensive survey of students' 9th grade math teachers' mindsets and practices (and other characteristics). A previous paper (Yeager et al., 2019) established that the growth mindset intervention improved 9th grade students' grades overall.

This analysis includes NSLM students with a valid math grade and a teacher who responded to the survey. We retain students who took two math courses with two different teachers, giving us a sample of 9,170 records (8,760 students) nested within 220 teachers. Our dependent variable is the grade the student received in the math course, as indicated by transcripts. Our measure of teachers' mindset is the average of two questions measured on a Likert scale (1=strongly disagree, 6=strongly agree): "People have a certain amount of intelligence and they really can't do much to change it" and "Being a top math student requires a special talent that just can't be taught." We reverse-coded these items, so higher values signal a more growth mindset and lower values signal a more fixed mindset, and bottom-coded it due to a skewed distribution.

Research Design:

For our main analysis, we estimate multilevel mixed effects models with fixed teacher intercepts and an interaction between the treatment effect and the math teachers' mindset, which we allow to randomly vary. This method allows us to consider differential selection into math

teachers' classrooms and different treatment effects within teachers while estimating the moderating effect of teachers' mindset on the treatment (Bloom et al, 2017). We also condition on additional student-level covariates (prior achievement, math level in 8th grade, expectations for success, race, gender, and parents' education) and teacher-level moderators (math pedagogical content knowledge, intelligence, racial implicit bias, education, years teaching, race, gender, and knowledge of growth mindset).

We supplement our results with an analysis of teachers' survey responses to identify the means through which teachers create an environment necessary for a growth mindset intervention to be fruitful. This is critical because students likely infer their teachers' mindsets by observing their actions (Haimovitz & Dweck, 2017).

Results:

In table 1, we do find a significant interaction between the treatment and the math teacher mindset, suggesting the effect of the treatment is moderated by the classroom context. Figure 1 displays this interaction as the average treatment effect on math grade by the teacher mindset. The estimated effect of the treatment is not significantly different from zero among students with teachers that have a more fixed mindset (<5). Students with teachers with a more growth mindset (>=5) do receive a significantly higher math grade after receiving the treatment. The average effect of the treatment is zero among students with fixed mindset teachers, but it is .09 among students with growth mindset teachers. Thus, students who received the growth mindset treatment on average received a .09 higher math grade than students in the control group in classrooms with growth mindset teachers. Findings are consistent when we condition on additional teacher-level measures in model 2. These findings suggest that growth mindset teachers create a classroom environment where students can benefit from the growth mindset intervention, but fixed mindset teachers hinder students' abilities to turn their increased motivation and learning strategies into higher grades after receiving the intervention.

Next, in table 2 we examine the practices more prevalent among growth mindset teachers. These practices reinforce the importance of teachers working collaboratively with students when they are struggling with problems and beliefs about math. In addition, growth mindset teachers create an environment where struggling students can ask for help and revise and resubmit work. This descriptive analysis reveals potentially important ways for teachers to structure their classrooms so students can benefit from a growth mindset intervention.

Conclusion:

Our findings suggest that an educational intervention for growth mindset only results in improved student achievement if the educational context provides opportunities for students to realize the benefits of their mindset. Our findings are relevant for basic models of human development because it identifies real-world mechanisms that account for surprisingly long-lasting effects of time-limited belief-change experiences. It is relevant for practice because it informs the development of new, context-level interventions to interact with existing person-level interventions. Finally, our findings contribute to ongoing debates about replicability of interventions and interpretations of effect sizes when study contexts differ. Short-term educational interventions can have lasting effects on student achievement, but the role of teachers in sustaining

References:

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Table 1: Results from Multilevel Mixed Effects Models with Math Teacher Fixed Intercepts at Random Slopes for Treatment

	Model 1	p	*Model 2*	p
Treatment x Math Teacher Mindset	0.069	0.004	0.073	0.004
	(0.024)		(0.025)	
Effect of Treatment by Teacher Mindset				
Growth	0.089	0.000	0.091	0.000
	(0.024)		(0.024)	
Fixed	-0.002	0.933	-0.004	0.861
	(0.025)		(0.025)	
Covariates Included				
Student-level Covariates	yes		yes	
Teacher-level Moderators	no		yes	

Student-level covariates include low achiever status, math level in 8th grade, students' expectations, race, gender, parents' education, and any flags for missing data.
Teacher-level moderators include race, gender, math pedagogical content knowledge, implicit racial bias, ravens scale, whether the teacher indicated having a masters' degree, and whether they heard about growth mindset before the survey, and any flags for missing data.

N	
Total N for records	9170
N for fixed mindset	4370
N for growth mindset	4790
Math Teacher N	220
Student N	8780

Table 2: Percent of Math Teachers Using Growth Mindset Practices by Their Growth Mindset Beliefs

Teacher Survey Questions	*Fixed Teachers*	*Growth Teachers*	*All Total*
Low achievers' questions slow down class (reverse)	52.94%	73.55%	64.13%
There is only one way to solve a problem (reversed)	60.78%	78.33%	70.27%
Math is learning facts and procedures (reversed)	52.94%	69.17%	61.71%
I allow my students to revise and resubmit their work	43.14%	53.72%	48.88%
In response to a struggling student, I say let's work together to fix what's wrong in the process	41.18%	50.83%	46.40%
In response to a struggling student, I explain things differently	37.25%	47.50%	42.79%
N	90	140	120

Figure 1