Worker Beliefs and Organizational Performance: Experimental Evidence from Teachers*

Daniel Chen, Jalnidh Kaur†

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Abstract

Frontline workers often exercise discretion in production environments where the mapping from effort to outcomes is difficult to learn. We study whether routine worker training can reshape beliefs about this production process and improve organizational performance. We study this idea through a field experiment with public school teachers in Pakistan. Teachers were randomized to receive an informational or psychosocial intervention. The informational treatments conveyed evidence on teacher value-added using stories or statistics, while the psychosocial treatment emphasized the malleability of student intelligence through a growth-mindset module. We find that the growth mindset treatment shifts teachers' beliefs in meaningful ways: it improves beliefs about the malleabilty of intelligence, and reduces stereotypes about first-generation learners as measured using Implicit Association Test. By contrast, exposure to narratives about teacher influence or to empirical evidence on teacher value-added yields no detectable shifts in implicit stereotypes. Students taught by teachers who received the growth mindset intervention show significant gains in learning outcomes, with improvements of 0.15 SD in mathematics, 0.19 SD in English, and 0.19 SD in Urdu relative to the control group. In contrast, the narrative and evidence interventions produce small and statistically insignificant effects on student achievement.

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†Chen: Toulouse School of Economics and NBER (Email: daniel.chen@iast.fr) Kaur: Department of Economics, University of Glasgow and CESifo (jalnidh.kaur@glasgow.ac.uk)

1 Introduction

Many production functions are complex and hard to learn: organizations and workers themselves often do not know the true mapping from effort to outcomes. This complexity limits the extent to which actions can be prescribed ex ante, requiring frontline workers to exercise substantial judgment over how tasks are performed and effort is allocated. The effectiveness of this discretion depends, in turn, on how workers understand the scope for their actions to influence outcomes. A large literature in personnel and organizational economics has studied how worker selection, incentives, monitoring, and management practices shape organizational performance (Finan et al., 2017; Hoffman and Stanton, 2025). Much less is known about whether organizations can reshape workers' mental models of production and whether doing so improves performance.

Schools provide a particularly useful setting in which to study this question. Teachers are frontline service providers who exercise considerable discretion over how instruction is delivered, while the mapping from their actions to student outcomes is difficult to learn because outcomes reflect multiple inputs and feedback is noisy. Teachers must therefore form beliefs about how learning is produced and about the scope for their own actions to matter. We document that these beliefs about the education production process vary systematically by student types: large shares of teachers report that gender, caste, and poverty predict students' ability to learn, and teachers expect substantially lower returns to effort for first-generation students.

We therefore study two approaches that organizations can use through routine worker training to shape how workers understand the production process. The first provides information about the returns to their own input, using either narratives or empirical evidence about teacher impact. The second targets a more fundamental belief about the production process: whether student ability is fixed or can develop through effort and support. Teachers who view ability as fixed may perceive less scope for their actions to matter, whereas those who view ability as malleable may perceive greater returns to their effort. This growth-mindset intervention therefore seeks to reshape how teachers interpret student ability and their own role in the education process.

We test these approaches in a field experiment with public-school teachers in Pakistan. Our study takes place in a setting where the majority of students are first-generation learners. We randomize 400 teachers across 36 schools to receive informational or growth-mindset treatments

and evaluate the effectiveness of these in influencing a range of teachers' beliefs and stereotypes. Additionally, we evaluate downstream effects on student learning using test-score data on 9,144 students taught by these teachers.

In the first arm, we expose teachers to a growth mindset training that targets beliefs about the elasticity of student intelligence. Teachers are exposed to the idea that student ability is not fixed and can be developed through practice, and that children from challenging backgrounds can succeed given the right support from teachers. These ideas are supplemented with real-life examples. The training also includes a role-model component, where a first-generation learner from a similar community shares their experience of overcoming disadvantage and fighting odds to achieve academic and professional success.

In the second arm, teachers are exposed to informational narratives centered around the role of teachers in shaping students' lives. The content consists of anecdotes and stories that illustrate the transformative impact teachers can have. This is followed by guided group discussions in which teachers recall influential teachers from their own schooling and reflect on moments when they felt their own actions made a difference for students. Thus, anecdotal sharing exposes teachers to a measure of local value-added of teachers.

In the third arm, teachers receive empirical evidence on teacher value-added. We draw on Chetty et al. (2011), which shows that teachers have sizable and lasting effects on students' educational attainment, earnings, and employment in adulthood. These findings are translated into an accessible format and delivered through a short trainer-led presentation, followed by a structured reflection exercise in which teachers discuss the channels through which everyday classroom practices can shape students' life trajectories. All treatments are administered through a mandatory training conducted during regular school hours to maximize participation.

We randomly assign teachers to one of the three treatments or to a placebo group. The placebo group receives a financial literacy course of an identical format over the same period as the treatment arms. Including a placebo arm serves two purposes. First, it ensures that any differences we observe are not driven by generic features of participating in a training session such as facilitator interaction or peer engagement. Second, it helps mitigate concerns about experimenter demand. This design therefore allows us to isolate the causal effect of treatment content from the effects of participating in a training more broadly.

We collect data on teachers' implicit and explicit biases through an endline survey conducted after the intervention. Explicit bias is captured using self-reports on survey items. To capture implicit bias, we use the Implicit Association Test (IAT), a widely used tool in social psychology that infers subconscious mental associations by comparing response times in rapid categorization tasks (Greenwald and Banaji, 1995) and is widely used in recent economics literature (Lowes et al., 2015; Carlana, 2019; Corno et al., 2022; Alesina et al., 2024). Unlike self-reports, which are susceptible to social desirability concerns, IAT scores provide an objective measure of underlying stereotypes that is difficult to manipulate. We design a special version for our setting to test for stereotypes against first-generation learners. We also measure beliefs about the malleability of intelligence using the standard growth mindset scale. Finally, we use administrative data on test scores in mathematics, English, and Urdu to assess the impact on student learning.

Our first main result is that targeting teachers' core beliefs about the malleability of intelligence, led to significant changes across various measures of beliefs and stereotypes, while the estimated effects of the informational interventions were generally smaller and less consistent. The growth mindset treatment markedly shifted teachers' beliefs about the malleability of intelligence: it increased the likelihood of holding a growth mindset by 15.5 percentage points (p-value = 0.006). Further, the growth mindset treatment reduced explicit prejudicial beliefs about disadvantaged students. Teachers were 19.6 percentage points (p-value = 0.002) less likely to agree that children from poor households are inherently less capable of learning and 7 percentage points (p-value = 0.07) less likely to believe that low parental education limited what teachers can accomplish. These changes extend to implicit attitudes as captured by IAT: the probability that a teacher exhibited severe implicit bias against first-generation learners dropped by 14.6 percentage points (p-value < 0.001), an 86 percent reduction relative to the control mean. By contrast, informational interventions, whether delivered through narratives or empirical evidence, did not produce statistically significant changes in most of these belief measures.

Secondly, the growth mindset treatment also produced sizable improvements in student achievement, as captured by centralized student assessments. Students taught by teachers in the growth mindset arm scored 0.15 SD higher in mathematics (p-value = 0.049), 0.18 SD higher in English (p-value = 0.012), and 0.19 SD higher in Urdu (p-value = 0.006) on standardized end-of-year assessments. These effect sizes compare favorably to other education interventions in similar contexts.

For example, communicating teacher expectations to students in Pakistan increased mathematics achievement by 0.18–0.21 SD (Asim et al., 2025), comparable to the gains we obtain through a teacher-focused psychosocial intervention. In contrast, the narrative and evidence-based informational treatments produced small and statistically insignificant effects on student learning across all subjects. Taken together, the results show that changing workers' mental models can improve organizational output.

We contribute to two main bodies of literature. Our first contribution is to the literature on civil servant and bureaucratic motivation, particularly the drivers of frontline-worker performance. Existing work has focused largely on financial incentives and intrinsic motivation (Muralidharan and Sundararaman, 2011; Lavy, 2009; Glewwe et al., 2010; Lee, 2018; Khan, 2025). Much less is known about whether light-touch, non-monetary interventions can reshape public-sector workers' beliefs and behavior.[1] We provide experimental evidence comparing informational interventions about teacher influence with a psychologically grounded intervention targeting beliefs about student potential, and find that workers' beliefs about the production environment may represent a potentially malleable margin for frontline performance.

Second, we contribute to the growing literature on stereotypes and implicit associations and their consequences for economic behavior. Prior work shows that stereotypical attitudes can be shifted through interventions that make biases salient or increase inter-group contact (Rao, 2019; Corno et al., 2022; Bursztyn et al., 2024). Within education, a growing literature documents systematic stereotypes among teachers and links teachers' implicit associations to student achievement, grading, and educational choices along dimensions including gender, caste, and immigration status (Carlana, 2019; Carlana et al., 2022; Alesina et al., 2024). We add to this literature by studying first-generation status and related dimensions of socioeconomic disadvantage, and by directly targeting teachers' beliefs about the malleability of student ability. We provide one of the first field experiments to manipulate these beliefs among teachers and show that the intervention shifts teachers' growth-mindset beliefs, reduces explicit stereotypes and implicit associations related to student disadvantage, and raises student achievement.[2]

[1] Related work studies non-monetary interventions in other organizational settings. Adhvaryu et al. (2023) find that soft-skills training raises productivity among garment workers in India, and Dustan et al. (2023) show that behaviorally informed messages improve compliance among civil servants in Peru.

[2] The closest related experiment is Hecht et al. (2023), who use a values-alignment intervention to motivate U.S. high-school teachers to adopt growth-mindset-supportive teaching practices and find gains in student achievement.

A closely related strand of work studies psychological interventions aimed at improving teacher performance in developing-country schools. The closest paper is Kaur (2025), who shows that strengthening teachers' general perceptions of control increases teacher effort and student learning. We study a related but distinct margin: teachers' mental models of education production, especially in the context of first-generation learners in the form of implicit stereotypes. Our growth-mindset intervention produces substantial reductions in implicit bias while improving student learning. Together, the two papers highlight distinct psychological forces shaping teacher performance and show that addressing these behavioral constraints can meaningfully improve educational outcomes.

The findings also have implications for the design of worker training. Organizations devote substantial resources to frontline-worker training, which typically emphasizes technical skills, procedures, or information. Recent evidence shows that soft-skills training can raise workplace productivity (Adhvaryu et al., 2023). Our results point to a complementary role for training that targets how workers understand the production environment. This may be particularly relevant where workers exercise substantial discretion and receive noisy feedback about the consequences of their actions. Although we study teachers, similar considerations arise in other frontline settings, including health care and public administration.

The rest of this paper is organized as follows: Section 2 outlines the motivation, Section 3 describes the design, and Sections 4 through 6 present the main results and discussion, and Section 7 concludes.

2 Motivation

Teachers routinely make multiple decisions often with limited information about the returns to their actions. Decisions about whether to exert effort, and how to allocate it across students and tasks, are influenced not only by pedagogy and incentives but also by beliefs about student ability, effort, and malleability. This section motivates our focus on teachers' beliefs in influencing teaching decisions. We document evidence of systematic belief distortions, discuss mechanisms through which beliefs may be updated, and explain how these insights inform our intervention design.

Their intervention targets adoption of specific teaching practices rather than directly targeting teachers' own beliefs about the malleability of student ability. Related psychology work experimentally shifts educators from deficit- toward strength-based beliefs about low-SES students Silverman et al. (2023), while Canning et al. (2019) document an association between faculty mindset beliefs and racial achievement gaps.

A growing body of work shows that teachers, parents, and students, often hold inaccurate beliefs about education production or the returns to effort leading to suboptimal behavior. Students underestimate the returns to study effort (Fryer Jr, 2016; Ersoy, 2023) parents hold inaccurate beliefs about child performance (Dizon-Ross, 2019). Evidence from large-scale surveys in low-, middle-, and high-income countries shows that many teachers believe their influence is limited for disadvantaged students (Sabarwal et al., 2018; Kaur, 2025). Such beliefs could be particularly consequential if held by primary school teachers who serve as the first institutional touchpoints for children including first-generation learners (FGLs). If teachers systematically underestimate the capability of students or their own ability to influence learning, these beliefs can translate into lower effort and expectations with adverse consequences for student learning.

Existing evidence highlights several approaches to shift beliefs. Information-based interventions have been shown to help agents update misperceptions and adopt behaviors more aligned with objective returns (Jensen, 2010; Wiswall and Zafar, 2015; Hastings et al., 2015; Conlon, 2021). Exposure to role models, particularly individuals who succeed despite adversity, can reshape beliefs about what is possible, raise aspirations, and counteract stereotypes (Beaman et al., 2012; Bernard et al., 2014; La Ferrara, 2016; Riley, 2024). Mindset interventions that are designed to change perceptions about the role of effort in success have been shown to improve student performance (Paunesku et al., 2015; Bettinger et al., 2018; Alan et al., 2019). We build directly on these insights in designing interventions that target education beliefs among primary school teachers.

The first intervention draws from the well-established psychological literature on growth mindset, which emphasizes the malleability of intelligence. At the student level, growth mindset interventions have been shown to improve academic performance, increase persistence, and strengthen peer relations (Aronson et al., 2002; Good et al., 2003; Blackwell et al., 2007; Paunesku et al., 2015; Yeager et al., 2011). However, there is remarkably little evidence on whether shifting beliefs of teachers, rather than students, about the malleability of intelligence can alter their behavior, reduce stereotypes, or improve student outcomes. In our context, where many teachers hold pessimistic beliefs about the potential of FGLs, this channel is likely to be particularly influential. Our treatment therefore seeks to directly target teachers' core mental models about student ability and potential.

The second and third treatment arms test two forms of informational interventions, designed to

address misperceptions about the importance of teachers in shaping long-term student outcomes. One arm presents teachers with anecdotes and narrative accounts of teacher influence. The approach draws on work in psychology showing that stories and anecdotal accounts can shape attitudes and behavior by fostering emotional engagement and identification (Lin-Siegler et al., 2016; Kaufman and Libby, 2012). The third arm provides empirical evidence on teacher value-added, specifically, findings from Chetty et al. (2011) linking early-grade teachers to long-term outcomes such as earnings and college attendance. Together, these two arms allow us to compare the effectiveness of narrative versus statistical information in updating beliefs, consistent with recent work highlighting systematic differences in how stories and data shape belief formation (Graeber et al., 2024).

Overall, the interventions allow us to study to two fundamental questions. First, do teachers' beliefs about student ability and their own role constitute meaningful constraints on their effectiveness? Second, do psychological interventions that target core beliefs about intelligence operate differently than informational interventions? By comparing these interventions, we examine whether training packages targeting different beliefs about the education production process generate different patterns of effects for teachers' beliefs and student outcomes.

3 Experimental Design

3.1 Setting

We collaborate with a network of public schools in Punjab, Pakistan. The schools are managed under a public-private partnership by a nonprofit education organization, which we refer to as the partner network. We embed the field experiment within the network's regular annual teacher-training program. In January 2022, the intervention was delivered across 36 schools through a 2-day workshop delivered remotely, consisting of two sessions of 3 hours each. The sample in the study comprises 400 primary school teachers and 9,144 students.

Table A1 shows sample characteristics for teachers in the study – 77% are female with an average of 8.5 years of experience. Around 60% hold a post-graduate degree, while around half are contractual teachers. All teachers teach primary grades from Nursery/Kindergarten upto Grade 5. Teachers are assigned to a specific class and teach all core subjects to that class, including Mathematics, English, and Urdu. Each class has an average of 38 students. A majority of teachers

report that more than half of their class consists of first-generation learners. Around 30% of teachers had a mother who never attended school, around 11% had a father who never attended school.

We asked teachers to respond to vignette questions that asked them to consider a particular student in class and state their expectation of how much the student's score would increase in response to an additional hour of weekly effort. Variants of the question altered whether the student is (a) high-performing or low-performing and (b) a first-generation learner (FGL) or not. Figure A1 plots the distribution for placebo group teachers and shows a clear gradient along both dimensions. Teachers expect substantially larger gains for high-performing students than for low-performing students. Conditional on performance, teachers expect higher returns when the student is not a first-generation learner. This pattern suggests that teachers perceive their own effort as more productive for students who are already advantaged in terms of prior achievement or parental education. Such perceptions provide a natural motivation for our study: if teachers believe their effort is less effective for disadvantaged students, they may underinvest in precisely the students who would benefit the most, reinforcing existing inequalities in the classroom.

3.2 Study Design

The study sample consisted of 400 primary-school teachers across 36 schools in the partner network who were already scheduled to participate in a routine teacher-training program in January 2022. We embedded the experimental content within this existing training program, with the research team serving as content providers. Thus, the intervention was delivered through the school network's existing professional-development infrastructure rather than as a stand-alone research activity.

We randomized teachers with equal probability to one of four experimental arms, without imposing equal arm sizes. The resulting allocation comprised 99 teachers in the growth mindset treatment, 97 in the narrative treatment, 96 in the evidence treatment, and 108 in the placebo group. Randomization was conducted at the teacher level without stratification. The four experimental arms were as follows:

1. *Growth Mindset Treatment:* Teachers were exposed to a a training module designed to shift beliefs about the malleability of intelligence. The session combined (i) a structured presen-

tation on the neuroscience behind the development of intelligence, emphasizing that ability grows through effort and supportive environments, (ii) examples of well-known individuals and local first-generation learners who succeeded despite adversity, and (iii) a virtual interaction with a role-model first-generation learner from a background similar to their students. Teachers discussed challenges in their own classrooms. This was followed by a writing exercise in which teachers summarized the key learnings from the workshop in the form of a letter to their principal.

2. *Narrative Treatment:* In the second treatment arm, teachers were informed about teacher value-added through carefully selected anecdotes and stories. The session included inspirational stories, drawn from public figures and everyday teachers, illustrating how teachers can transform students' lives, particularly by shaping aspirations, offering encouragement, and building strong teacher–student relationships. Activities encouraged teachers to recall influential teachers from their own schooling and reflect on moments when their actions made a difference for a child. This was followed by a writing exercise in which teachers summarized the key learnings as a letter to their younger selves.

3. *Empirical Evidence Treatment:* Our third treatment group attended a training in which teachers were informed about teacher value-added, through empirical evidence in Chetty et al. (2011). The content emphasized how early-grade teachers affect long-term outcomes such as college attendance, employment, earnings, and non-cognitive skills. Facilitators led discussions on the mechanisms through which teacher quality matters, and teachers completed short exercises summarizing key lessons for a colleague. This was followed by a writing exercise in which teachers summarized the key learnings as a letter to their younger selves.

4. *Placebo Group:* Teachers in the control arm received a training of similar length and format to the other arms, but covering a neutral topic - financial literacy. The content focused on procedures for opening a bank account in Pakistan.

3.3 Data and Outcomes

Data were collected using one round of data collection after the intervention. These consisted of one-to-one interviews with teachers and interaction with a computer interface. Our main outcomes of

interest at the teacher level are teachers' beliefs and perceptions about first-generation learners. We also access school administrative records on student test-scores as measures of student achievement after the intervention.

Explicit Bias. We capture explicit bias through a teacher module that asks teachers to indicate their level of agreement with a series of statements. The statements capture bias on the lines of caste, gender, poverty, and parental education.

Implicit Bias. We capture implicit bias and teachers' stereotypes about disadvantaged students through an Implicit Association Test (IAT). In the task, teachers are asked to assign words to categories. Reaction times are compared across trials when pairings are consistent with stereotypes vs. when they are not. We develop and employ an adapted version of the IAT to capture implicit associations toward disadvantaged students, with particular relevance to first-generation learners. Appendix B reports the exact category labels, stimulus words, and additional details on the construction of the measure.

Growth Mindset. We measure teachers' growth mindset using Dweck's (2006) three-item scale, which captures beliefs about the malleability of intelligence. The three items are: (1) "You have a certain amount of intelligence, and you can't really do much to change it." (2) "Your intelligence is something about you that you can't change very much." (3) "You can learn new things, but you can't really change your basic intelligence." Teachers reported their level of agreement with each item using a Likert scale.

Perceived Returns to Effort. We use a vignette question asking teachers to report their expected score for different types of students in return for exerting an additional hour of effort in a week. Responses are used to elicit perceived returns to effort for students with different backgrounds.

Student Learning. We capture student learning using administrative data on student test-scores across three subjects - Maths, English, and Urdu. We received administrative data on one class per teacher, hence each student is uniquely linked to a single class teacher. Student treatment status

is defined by that teacher's randomized assignment. Given that the school network has centralized examinations across all schools, we standardize exam scores within grade to have a mean of zero and SD of one for the placebo group. The academic calendar consists of a two-term annual system, with the first term going from April till August, and the second from September until February. We collect scores from exams conducted in February, 2022 across the school chain as our outcome variable. These reflect effects of training a month after the intervention.

Additionally, we also collected data on student stress and reports of classroom climate from students, through a brief student survey conducted after the intervention.

3.4 Empirical Strategy

We estimate the effect of each treatment arm on outcomes at endline. The key specification for teacher-level outcomes is:

$$y_j = \beta_0 + \beta_1 GrowthMindset_j + \beta_2 Narrative_j + \beta_3 Evidence_j + \epsilon_j. \tag{1}$$

Here, j indexes teachers. The coefficients of interest are β_1, β_2, and β_3, which estimate the effect of assignment to each treatment arm relative to the omitted placebo group. In some specifications, we pool the narrative and evidence arms into a single information-treatment indicator.

For student-level outcomes, we estimate:

$$y_i = \beta_0 + \beta_1 GrowthMindset_j + \beta_2 Narrative_j + \beta_3 Evidence_j + \nu_g + \mu_s + \epsilon_i. \tag{2}$$

Here, i indexes students, j indexes the teacher assigned to student i, g indexes grade, and s indexes school. The terms ν_g and μ_s denote grade and school fixed effects, respectively. Each student's treatment status is determined by the randomized assignment of their class teacher. Since treatment is assigned at the teacher level, we cluster standard errors at the teacher level across all specifications (Abadie et al., 2017).

4 Results

4.1 Experimental Integrity

Table A2 reports summary statistics for teacher characteristics across all experimental arms and tests for balance. Across a broad set of observable attributes, we find that the means are similar across groups. Pairwise comparisons (columns 6–12) show that two differences are statistically significant at conventional levels, no more than what would be expected by chance. For example, teachers in the Narrative arm have slightly more educated fathers than those in the Growth Mindset arm, and the difference is statistically significant at 5% level of significance. Teachers in the Evidence arm are more likely to hold a Masters degree compared to those in the Narrative arm, the difference is significant at 10% level of significance. No other consistent differences in observables emerge. Overall, we interpret the table as showing no broad pattern of systematic differences across experimental arms.[3] As an additional balance check, we regress each treatment-assignment indicator on the full set of predetermined teacher characteristics. The covariates are jointly insignificant in predicting assignment to the Growth Mindset, Narrative, and Evidence arms (omnibus F-test p-values = 0.79, 0.77, and 0.70, respectively).

4.2 Growth Mindset

The growth mindset intervention generated large and statistically significant improvements in teachers' beliefs about the malleability of intelligence. As shown in Table 1, teachers assigned to the growth mindset arm scored 0.43 standard deviations (p-value = 0.002) higher on the standardized psychological scale relative to the placebo group, an effect significant at the 1 percent level. The corresponding effect on the first principal component of the items in the scale is similar in both magnitude and precision. Following standard practice in the psychology literature (e.g., Blackwell et al., 2007; Paunesku et al., 2015), we also construct a binary indicator that classifies teachers as having a growth mindset if their average score on the six-point scale is 4 or higher. We find that the psychological treatment raises the likelihood of holding a growth mindset by 15.5 percentage points (p-value = 0.006). In contrast, the estimated effects of the informational interventions

[3] Nonetheless, we show robustness using specifications which control for these covariates which showed imbalance.

are smaller and less consistent across the measures. The narrative treatment produces a positive estimate on the PCA measure, while the evidence treatment reduces the binary growth-mindset measure; the remaining estimates are statistically indistinguishable from zero. These results show that only the psychological intervention meaningfully shifts teachers' beliefs about the malleability of intelligence, whereas the informational interventions leave these beliefs largely unchanged.

4.3 Explicit Bias and Stereotypes

Table 2 reports the effects on teachers' explicit prejudices across different dimensions of student background. The growth mindset intervention led to meaningful reductions in stereotypical beliefs related to poverty and parental education, while gender- and caste-related beliefs were unaffected. Col 3 shows that teachers in the growth mindset arm were 19.6 percentage points (p-value = 0.002) less likely to agree that children from poor households are inherently less capable of learning. Given control group mean of 0.4, this corresponds to a 49% reduction in the probability of reporting the belief. Similarly, column 4 shows that teachers in the growth mindset treatment arm are 7 percentage points (p-value = 0.07) less likely to believe that low parental education limits what teachers can accomplish. This corresponds to a 58% reduction relative to the control group mean of 12 percent.

In contrast, the informational treatments yield smaller and less consistent effects. Both the narrative and evidence interventions lead to modest but statistically significant reductions of about 8 percentage points in the likelihood that teachers view low parental education as limiting what they can achieve through effort, relative to the control mean of 12 percent.

Notably, the placebo-group means also indicate that these stereotypical beliefs are common in the setting: 44% of teachers agree that a child's gender can predict how well the student will fare, 54% agree that caste background affects how well a child can learn, and 40% agree that children from poor backgrounds are less capable of learning. The fact that teachers openly endorse these views in a self-reported survey suggests that such beliefs are socially acceptable. We do not detect statistically significant effects of any treatment on the gender- or caste-related belief measures. This pattern may indicate that these particular beliefs are less responsive to the interventions tested here, although the estimates are not sufficiently precise.

4.4 Implicit Bias

To capture implicit bias, we use the Implicit Association Test (IAT) to capture implicit associations between success-privilege and failure-underprivileged (vs. success-underprivilege and failure-privilege). Considering the IAT thresholds typically used in the social psychological literature, a negligible fraction of teachers associate success with first-generation learners (FGLs), 34% present little to no clear association, 42% show FGL-failure association, and 24% show moderate to severe association between FGLs and failure.[4]

Table 3 reports the effects of the interventions on teachers' implicit bias against first-generation learners, as measured by the IAT. Higher values on the standardized IAT score indicate lower implicit bias. The growth mindset intervention leads to a modest reduction in implicit bias: teachers in this arm score 0.235 standard deviations higher than the control group (p-value = 0.097), indicating weaker subconscious associations between success and privilege. This improvement is particularly pronounced at the severe end of the distribution. Although the intervention does not significantly change the likelihood of having at least some implicit bias (IAT $<$ –0.15), it substantially reduces the prevalence of severe bias (IAT $<$ –0.35). Teachers exposed to the growth mindset intervention are 14.6 percentage points (p-value $<$ 0.001) less likely to fall into this category relative to a control group mean of 17 percent, reflecting an 86 percent reduction in severe implicit bias. In contrast, none of the informational interventions meaningfully affect any of the implicit bias measures. Neither treatment shifts the standardized IAT score or the categorical measures.

Together, these findings show that the psychological intervention meaningfully reshapes teachers' implicit attitudes, whereas informational approaches leave subconscious stereotypes largely unchanged.

4.5 Student Learning

Table 4 presents the effects of the interventions on student learning, measured using standardized scores in mathematics, English, and Urdu from centralized end-of-year assessments. The growth

[4]We code the IAT so that lower scores indicate stronger implicit associations between student disadvantage and negative attributes, while higher scores indicate weaker such associations. Following the conventional magnitude thresholds in Greenwald et al., 2003, we classify scores below -0.15 as indicating some anti-disadvantaged-student bias and scores below -0.35 as indicating moderate-to-severe bias. Scores between -0.15 and 0.15 are classified as little to no bias, while scores above 0.15 indicate associations in the opposite direction. Figure 1 shows the bias classification thresholds.

mindset intervention generated consistent and statistically significant improvements across mathematics and languages. Specifically, students taught by teachers in the growth mindset arm scored 0.15 standard deviations higher in mathematics (p=0.049), 0.18 standard deviations higher in English (p=0.012), and 0.19 standard deviations higher in Urdu (p=0.006) relative to the placebo group. These effects are sizable in the context of education interventions in low-income settings. In contrast, the informational treatments, whether pooled or examined separately, did not produce measurable effects on student outcomes. Coefficients for both the narrative and evidence treatment arms are small in magnitude and statistically indistinguishable from zero across all subjects.

Although the training was brief, the classroom behavior it sought to influence is repeated throughout the school day. A change in how teachers interpret students' difficulties could affect their explanations, feedback, expectations, and willingness to persist with struggling learners across many subsequent interactions. Such changes may be especially consequential where teachers underestimate the potential of first-generation learners. Evidence linking teachers' developmental thinking to independently observed teaching quality supports the plausibility of this account (Kundrak et al., 2026). A separate experiment in Pakistan provides a benchmark for the speed and scale of achievement responses: Asim et al. (2025) report a mathematics effect of approximately 0.21 SD within 2–4 weeks of communicating personalized teacher expectations.[5] Our estimated test-score differences of approximately 0.15–0.19 SD after one month are therefore consistent in order of magnitude with a documented short-run response to teacher communication. The interventions and populations differ, and our data do not establish which classroom behaviors mediate the effects or whether the gains persist.

4.6 Heterogeneity

Next, we investigate whether treatment effects vary by teacher characteristics: gender, education, experience, and first-generation status of the teacher. These analyses are exploratory and are intended to describe potential patterns of treatment-effect heterogeneity rather than to test primary hypotheses. Given the number of interaction tests and the limited statistical power for detecting heterogeneous effects, we interpret individual estimates cautiously.

[5] Asim et al. (2025) study students in grades 3–8, while our sample consists of younger students in kindergarten through grade 5.

The most suggestive pattern is heterogeneity by teaching experience. For teachers' own growth mindset, the psychological treatment has significantly larger effects for less experienced teachers (Table 7, col. 1, p-value for the interaction coefficient = 0.014). For implicit bias (IAT), the growth mindset treatment reduces bias more for less experienced teachers, although this interaction is only marginally significant (Table 8, col. 1, p-value for the interaction coefficient = 0.098). For both growth mindset and implicit bias, we find no systematic heterogeneity by teacher gender, postgraduate education, or first-generation learner status.

For student learning, treatment effects do not vary systematically by teacher gender, postgraduate education, or experience. However, there is suggestive evidence that the combined information treatment is more effective for teachers who are themselves first-generation learners (Table 9, col. 4, p-value for the interaction = 0.050).

5 Robustness

5.1 Experimenter Demand

Our results are unlikely to be driven by experimental demand effects. First, the inclusion of a placebo group in the study design mitigates concerns about experimenter demand. Teachers in the placebo group received a training of an identical duration, structure, and group format as the treatment arms, but on a neutral subject topic, that is financial literacy, which is unlikely to directly influence the outcomes we study. Any differences in outcomes are unlikely to stem from features of the training such as facilitator interactions or group dynamics.

Second, while some survey-based measures of teachers' beliefs such as explicit bias, or growth mindset could in principle be affected by social desirability concerns, our main psychological outcome, the Implicit Association Test (IAT), is very difficult to manipulate. Prior work shows that (a) individuals are generally unable to strategically alter their IAT responses (Egloff and Schmukle, 2002), and (b) that IAT scores correlate strongly with real-world behavior and decisions (Bertrand et al., 2005; Carlana, 2019; Glover et al., 2017).

In addition, our key behavioral outcomes—student test scores—are objective and come from standardized assessments administered independent of the research team. Together, these patterns suggest that experimental demand effects are unlikely to explain our results.

5.2 Spillovers

The experiment randomly assigned treatments among 400 teachers across 36 schools in the study. This design generates variation in treatment status for teachers within the same school, raising the possibility of spillovers as teachers across different arms may interact with each other.

While such spillovers could exist in principle, we argue that these are unlikely to be large enough to drive our main results. Conceptually, in the presence of spillovers from any of the treatments to the control group, we expect our treatment effects to be attenuated. Thus, spillovers would lead us to underestimate the treatment effects.

Our experimental design allows us to partially test for the extent of these potential spillover effects. The randomization design generated exogenous variation in the fraction of teachers assigned to each treatment arm within schools. We exploit this variation across schools to test for spillovers. We use two specifications.

First, we test whether outcomes for placebo teachers differ depending on the share of their colleagues who received the growth mindset (T1), narrative (T2), or evidence-based (T3) intervention. If having more treated teachers in a school generates more opportunities for interactions across treatment and placebo groups, then the outcomes of placebo teachers should vary with the fraction of colleagues receiving any of the treatments. Table 5 examines this hypothesis. Across math, English, and Urdu test scores, the estimated coefficients are small and generally statistically insignificant. The only exception is a negative association between the share of narrative-treated colleagues and Urdu scores, but no corresponding effects appear for math or English. Overall, we find no consistent evidence that placebo teachers' outcomes are influenced by the fraction of treated teachers in their school.

Second, we examine whether the effectiveness of each intervention varies with the fraction of colleagues in the same treatment arm within a school. We estimate specifications that interact each treatment indicator with the corresponding school-level share of teachers assigned to that same treatment (Table 6). Across Math, English, and Urdu, the interaction terms are generally small and statistically insignificant, indicating that treatment effects do not systematically differ by treatment saturation.

Taken together, these findings indicate that treatment effects are stable regardless of how many

colleagues receive the same treatment, thus any spillovers across treatment and placebo arms are negligible and likely insufficient to explain the main results.

6 Mechanisms and Discussion

While our experiment was not designed to recover a full set of mechanisms, the pattern of results suggests several plausible channels through which the psychological intervention may have improved student learning, whereas the informational interventions fell short.

The growth mindset treatment likely shifted teachers' underlying beliefs about teacher and student potential. Teachers exposed to the growth mindset content exhibited a positive shift in beliefs about the malleability of student intelligence, reduced explicit stereotypes based on poverty and parental education, and a large decline in severe implicit bias toward first-generation learners, consistent with an upward revision of beliefs about what teachers and their students can achieve. These shifts in beliefs were accompanied by positive effect on student learning as captured by standardized test scores.

One mechanism through which these belief shifts may have translated into higher student learning is through better teacher effort and teacher–student interactions. We collect data on coarse measures of effort including attendance and teaching hours. Table A3 shows that there are no detectable changes in these observable effort margins suggesting that the gains could not have arisen from changes in the quantity of interactions. This suggests instead that, the quality margin might be more relevant. Although we are constrained in terms of data on classroom climate and granular measures of in-class effort, we speculate that the intervention could have altered how teachers responded to student difficulties, the feedback they provided, or the encouragement they offered to students. Second, we collect data on student stress and observe reductions in self-reported stress, a channel consistent with evidence that growth-mindset framing can lower performance anxiety and help students engage more productively with classroom instruction. Table A4 shows a 0.07 SD (p-value = 0.044) reduction in self-reported stress among students in the growth mindset treatment arm, with corresponding detectable changes in any of the informational arms.

More broadly, the pattern of effects differs across the experimental arms. The student-potential intervention generated larger and more consistent changes across several measures of teacher beliefs

and student outcomes, whereas the narrative and evidence interventions generated smaller and less consistent effects. The interventions differ both in the constructs they target and in their mode of delivery: the student-potential arm combines psychologically grounded content on the malleability of intelligence with examples and role-model exposure, whereas the narrative and evidence arms provide information about teacher influence. Accordingly, these contrasts should be interpreted as comparisons across intervention packages rather than as identifying whether differences in outcomes arise from the target construct, the mode of delivery, or a particular intervention component.

Taken together, the results are consistent with the possibility that teachers' beliefs about student potential are an important margin in this setting. One interpretation is that teachers in the setting may hold strong priors, shaped by years of experience in resource-constrained classrooms, about which children are likely to succeed. Informational treatments that simply present statistics or stories might do little to dislodge these priors, especially when they conflict with daily classroom observations. In contrast, the growth mindset intervention appears to have targeted foundational beliefs about the mechanics of education production: reframing intelligence as changeable is likely to have altered how teachers interpreted student struggle, making them more likely to attribute poor performance to effort or context rather than fixed ability.

7 Conclusion

Frontline workers often exercise substantial discretion in environments where the mapping from effort to outcomes is difficult to observe and learn. In this paper, we study whether routine worker training can alter how teachers understand the education production process and whether such interventions affect organizational performance.

We randomly assign 400 primary-school teachers in Pakistan to a growth-mindset intervention targeting beliefs about the malleability of student ability, two interventions providing narrative or empirical information about teacher influence, or a placebo training. The growth-mindset intervention shifts teachers' beliefs about the malleability of intelligence, reduces several explicit stereotypes about disadvantaged students, and weakens severe implicit associations between student disadvantage and negative attributes. Students taught by teachers in this arm also perform substantially better on standardized assessments one month later. The narrative and evidence interventions

generate smaller and less consistent changes across the teacher-belief measures and no statistically detectable gains in student achievement.

These results suggest that workers' beliefs about the production environment may represent an important and potentially malleable margin of organizational performance. At the same time, the experiment does not isolate a single mechanism. The growth-mindset arm combines content on the malleability of intelligence with examples of successful disadvantaged learners and role-model exposure, while the informational arms target beliefs about teacher influence using different forms of evidence. Comparisons across arms should therefore be interpreted as comparisons between intervention packages rather than as identifying whether differences in outcomes arise from the target construct, the mode of delivery, or any particular component.

The findings also provide evidence that teachers' beliefs and stereotypes about disadvantaged students may be consequential in settings where frontline providers exercise considerable discretion over whom to support and how intensively. Our adapted IAT further highlights implicit associations related to student disadvantage, with particular relevance to first-generation learners. More broadly, the results motivate further work on whether training that targets workers' understanding of complex production environments can improve performance in other settings characterized by discretion and noisy feedback.

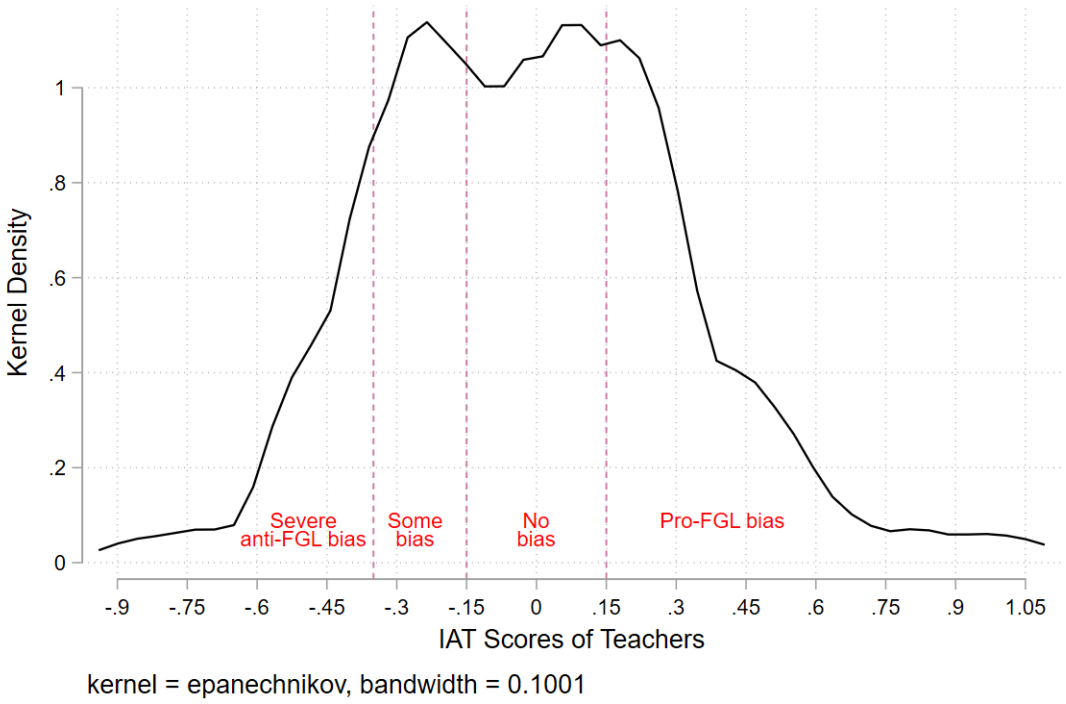
The results should be viewed as proof of concept rather than evidence of scalable effectiveness. The intervention was implemented within an existing teacher-training program and student outcomes were measured over a relatively short horizon. Whether these effects persist, replicate in other school systems, or can be reproduced cost-effectively at larger scale remains an open question.

Wide learning gaps despite substantial public spending have motivated extensive work on barriers to effective education service delivery in developing countries. Given the central role of teachers in the education production process, much of this literature has focused on incentives, monitoring, management, and pedagogical inputs as ways to improve teacher effectiveness. Our findings point to an additional margin: the beliefs and mental models that frontline workers bring to the production process may themselves be malleable through targeted interventions. This opens a broader research agenda on how organizations can shape such beliefs, how changes in beliefs affect workers' decisions and the allocation of effort, and whether these approaches can generate persistent improvements in service delivery. From a policy perspective, the results provide proof-of-concept

evidence motivating further experimentation with teacher-focused belief interventions, including tests of their persistence, cost-effectiveness, and effectiveness under larger-scale implementation.

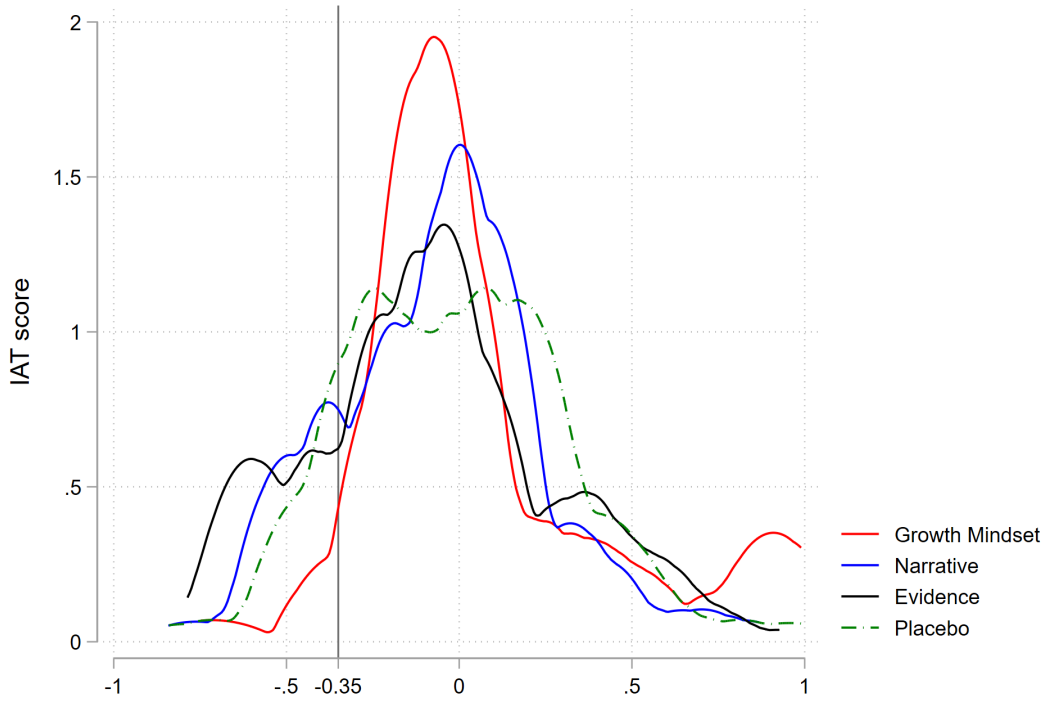
Figures

Figure 1: IAT Scores and Bias Thresholds



Notes: This figure plots the distribution of Implicit Association Test (IAT) scores for the placebo group teachers together with the bias classification thresholds following Greenwald et al. (2003): Values closer to zero indicate little or no implicit bias and larger magnitudes indicate stronger implicit associations. The IAT in our setting is adapted for first-generation learners, and measures implicit associations between success–privilege and failure–underprivilege. We code the IAT such that negative scores reflect bias against first-generation learners (FGLs) and positive scores reflect bias in favor of FGLs. Using the cutoffs, scores above 0.15 indicate pro-FGL bias, scores between –0.15 and 0.15 indicate little to no bias, scores between -0.15 and -0.35 indicate mild anti-FGL bias, and scores below -0.35 indicate moderate to severe anti-FGL bias. Vertical dashed lines denote these thresholds.

Figure 2: Distibution of IAT Scores by Treatment



Notes: This figure plots kernel density estimates of teachers' Implicit Association Test (IAT) scores by treatment arm. The IAT measures implicit associations between success–privilege and failure–underprivilege, with higher scores indicating less implicit bias against first-generation learners. The vertical line at –0.35 marks the threshold used to classify teachers as exhibiting "severe" implicit bias, scores below -0.35 indicate severe bias against FGLs. Densities are shown separately for the Growth Mindset (T1), Narrative (T2), Evidence (T3), and placebo groups.

Tables

Table 1: Impact on Growth Mindset of Teachers

	Pooled treatment arms			Disaggregated treatment arms		
	(1) Z-score	(2) Binary measure	(3) PCA	(4) Z-score	(5) Binary measure	(6) PCA
Growth Mindset (T1)	0.433***	0.155***	0.423***	0.433***	0.155***	0.423***
	(0.137)	(0.056)	(0.150)	(0.137)	(0.056)	(0.150)
Info Treatment (T2 + T3)	0.064	-0.056	0.155			
	(0.145)	(0.056)	(0.183)			
Narrative (T2)				0.148	0.039	0.269*
				(0.134)	(0.063)	(0.140)
Evidence (T3)				-0.020	-0.152**	0.040
				(0.218)	(0.067)	(0.311)
Control Mean	0.00	0.70	0.00	0.00	0.70	0.00
R-squared	0.02	0.04	0.01	0.02	0.06	0.01
Observations	400	400	400	400	400	400

Notes: This table reports treatment effects on teachers' growth mindset. The outcome Z-score is the standardized average of responses to the three items in Dweck's growth mindset scale, where higher values indicate a stronger growth mindset. The binary measure equals 1 if the teacher's average score on the scale is greater than or equal to 4. The PCA measure is the standardized first principal component of the three growth-mindset items, following the approach in Alan et al. (2019). The continuous outcomes are standardized using the placebo group mean and standard deviation. "Growth Mindset," "Narrative," and "Evidence" are indicator variables for assignment to the corresponding treatment; "Info Treatment" pools the Narrative and Evidence groups. All regressions are estimated with robust standard errors clustered at the teacher level. $p < 0.10$, *$p < 0.05$, **$p < 0.01$.

Table 2: Impact on Teachers' Prejudices based on Student Background

	Pooled treatment arms				Disaggregated treatment arms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Gender	Caste	Poverty	Parental Education	Gender	Caste	Poverty	Parental Education
Growth Mindset (T1)	0.061	0.069	-0.196***	-0.070*	0.061	0.069	-0.196***	-0.070*
	(0.070)	(0.069)	(0.062)	(0.038)	(0.070)	(0.069)	(0.062)	(0.038)
Info Treatment (T2 + T3)	-0.004	0.002	0.016	-0.084**				
	(0.060)	(0.060)	(0.059)	(0.034)				
Narrative (T2)					-0.022	0.071	0.014	-0.079**
					(0.070)	(0.069)	(0.069)	(0.037)
Evidence (T3)					0.014	-0.068	0.019	-0.089**
					(0.070)	(0.070)	(0.069)	(0.036)
Control Mean	0.44	0.54	0.40	0.12	0.44	0.54	0.40	0.12
R-squared	0.00	0.00	0.03	0.02	0.00	0.01	0.03	0.02
p-value: T1 = T2 + T3	0.297	0.272	0.000	0.583				
Observations	400	400	400	400	400	400	400	400

Notes: The dependent variable in columns (1)-(4) denotes indicator for agreement with the below statements respectively: (1) Gender can predict how well the student will fare. (2) A child's caste background affects how well they can learn. (3) Children from poor backgrounds are less capable of learning. (4) There is little that I can do to help a student learn if parents don't have the necessary education to help the child. Standard errors are clustered at the teacher level. *** p<0.01, **p<0.05, * p<0.1.

Table 3: Impact on Implicit Bias (IAT scores)

	Pooled treatment arms			Disaggregated treatment arms		
	(1)	(2)	(3)	(4)	(5)	(6)
	IAT Z-Score	Severe Bias	Some Bias	IAT Z-Score	Severe Bias	Some Bias
Growth Mindset (T1)	0.235*	-0.146***	-0.077	0.235*	-0.146***	-0.077
	(0.141)	(0.039)	(0.066)	(0.141)	(0.039)	(0.066)
Info Treatment (T2 + T3)	-0.178	0.015	-0.043			
	(0.114)	(0.046)	(0.058)			
Narrative (T2)				-0.153	0.019	-0.060
				(0.128)	(0.054)	(0.067)
Evidence (T3)				-0.203	0.010	-0.025
				(0.140)	(0.053)	(0.068)
Control Mean	0.03	0.17	0.38	0.03	0.17	0.38
R-squared	0.03	0.04	0.00	0.03	0.04	0.00
Observations	400	400	400	400	400	400

Notes: This table reports treatment effects on teachers' implicit bias against first-generation learners, measured using the Implicit Association Test (IAT). The IAT score is coded such that higher values indicate less prejudice against first-generation learners. The "IAT Z-Score" is the standardized IAT score, normalized using the placebo group mean and standard deviation. "Severe Bias" is an indicator equal to 1 if the teacher's IAT score is below –0.35, and "Some Bias" is an indicator equal to 1 if the score is below –0.15. *** p<0.01, **p<0.05, * p<0.1

Table 4: Impact on Student Learning

	(1) Maths	(2) English	(3) Urdu	(4) Maths	(5) English	(6) Urdu
Growth Mindset (T1)	0.155**	0.187**	0.192***	0.154**	0.188**	0.192***
	(0.078)	(0.074)	(0.070)	(0.078)	(0.074)	(0.070)
Information (T2 + T3)	0.055	0.013	0.080			
	(0.066)	(0.067)	(0.056)			
Narrative (T2)				0.011	0.029	0.094
				(0.079)	(0.076)	(0.066)
Evidence (T3)				0.100	-0.004	0.065
				(0.077)	(0.080)	(0.066)
Observations	9144	9144	9144	9144	9144	9144
R-squared	0.05	0.06	0.05	0.05	0.06	0.05

Notes: The dependent variable is students' score in Maths, English, Urdu in the centralized assessment in February, standardized within grade to have a mean of zero and SD of one for control group. The omitted category is the placebo group. All specifications account for school fixed effects. Standard errors are clustered at the teacher level. *** p<0.01, **p<0.05, * p<0.1

Table 5: Impact of Treatment Intensity on Placebo Students' Outcomes

	Maths			English			Urdu		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fraction of T1 peers	-0.177			-0.336			-0.059		
	(0.292)			(0.303)			(0.319)		
Fraction of T2 peers		-0.376			-0.408			-0.736***	
		(0.264)			(0.301)			(0.270)	
Fraction of T3 peers			-0.115			-0.263			-0.294
			(0.395)			(0.476)			(0.403)
Observations	2446	2446	2446	2446	2446	2446	2446	2446	2446
R-squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00

Notes: The sample is restricted to placebo teachers and their students. Each coefficient comes from a separate regression of placebo student test scores on the fraction of teacher's peers in the same school assigned to a given treatment arm (T1: growth mindset; T2: narrative; T3: evidence treatment). Treatment intensity is defined using leave-one-out shares, i.e., the fraction of a teacher's school colleagues — excluding the teacher themselves — assigned to each treatment. In the placebo subsample, these intensity measures vary only at the school level, so school fixed effects are not included. Standard errors are clustered at the teacher level and reported in parentheses. *** p<0.01, **p<0.05, * p<0.1

Table 6: Heterogeneity in Treatment Effects by Within-School Treatment Intensity

	(1) Maths	(2) English	(3) Urdu
Fraction of GM peers x GM Indicator	0.339	0.224	0.023
	(0.542)	(0.544)	(0.464)
Fraction of Narrative peers x Narrative Indicator	-0.471	0.384	0.393
	(0.539)	(0.457)	(0.506)
Fraction of Evidence peers x Evidence Indicator	0.010	0.552	0.130
	(0.661)	(0.453)	(0.373)
Observations	9144	9144	9144
R-squared	0.05	0.07	0.05

Notes: Each column reports estimates from regressions that interact a teacher's own treatment assignment with the leave-one-out fraction of colleagues in the same treatment arm within the school. The interaction coefficients capture whether the effectiveness of the growth mindset (GM), narrative, or evidence-based intervention varies with the intensity of that treatment among colleagues. All specifications include school fixed effects, grade fixed effects, the main effects of each treatment indicator, and the corresponding peer-share variables. Standard errors are clustered at the teacher level and reported in parentheses.

Table 7: Heterogeneous Effects on Growth Mindset by Teacher Characteristics

	(1) Experience	(2) Gender	(3) Education	(4) FGL status
Growth Mindset (T1)	0.989***	0.471***	0.393**	0.378**
	(0.283)	(0.152)	(0.197)	(0.183)
Info Treatment (T2 + T3)	0.502	0.057	-0.118	0.036
	(0.321)	(0.176)	(0.221)	(0.185)
Het. Variable	0.036*	0.186	-0.231	0.220
	(0.021)	(0.227)	(0.191)	(0.199)
Het. Variable*Growth Mindset	-0.066**	-0.185	0.067	0.102
	(0.027)	(0.349)	(0.272)	(0.270)
Het. Variable*Info Treat	-0.050	-0.014	0.308	0.032
	(0.033)	(0.305)	(0.293)	(0.297)
Observations	400	400	400	400
R-squared	0.03	0.02	0.02	0.03

Notes: This table tests for heterogeneous treatment effects on teachers' growth mindset by teacher characteristics. The dependent variable across all columns is the standardized growth mindset score. The column header shows the heterogeneity variable for each column. Teacher experience is a continuous variable denoting total years of teaching experience. Teacher education takes the value 1 if the teacher holds a postgraduate degree. FGL status is an indicator for whether the teacher herself has either parent who has zero years of education. Standard errors are clustered at the teacher level. *** p<0.01, **p<0.05, * p<0.1

Table 8: Heterogeneous Effects on Implicit Bias (IAT) by Teacher Characteristics

	(1) Experience	(2) Gender	(3) Education	(4) FGL status
Growth Mindset (T1)	0.618**	0.288*	0.311	0.185
	(0.268)	(0.167)	(0.208)	(0.180)
Info Treatment (T2 + T3)	0.067	-0.268**	0.132	-0.128
	(0.238)	(0.132)	(0.159)	(0.143)
Het. Variable	0.023	-0.097	0.362**	0.028
	(0.019)	(0.200)	(0.174)	(0.194)
Het. Variable*Growth Mindset	-0.045*	-0.244	-0.128	0.121
	(0.027)	(0.289)	(0.281)	(0.293)
Het.Variable*Info Treat	-0.028	0.363	-0.521**	-0.132
	(0.023)	(0.257)	(0.223)	(0.240)
Observations	400	400	400	400
R-squared	0.03	0.04	0.04	0.03

Notes: This table tests for heterogeneous treatment effects on teachers' implicit bias against first-generation learners, as captured using the implicit association test (IAT). The IAT score is coded such that higher values indicate less prejudice against first-generation learners. The dependent variable across all columns is the standardized IAT score. The column header shows the heterogeneity variable for each column. Teacher experience is a continuous variable denoting total years of teaching experience. Teacher education takes the value 1 if the teacher holds a postgraduate degree. FGL status is an indicator for whether the teacher herself has either parent who has zero years of education. Standard errors are clustered at the teacher level. *** p<0.01, **p<0.05, * p<0.1

Table 9: Heterogeneous Effects on Student Learning by Teacher Characteristics

	(1) Experience	(2) Gender	(3) Education	(4) FGL status
Growth Mindset (T1)	0.079	0.137*	0.125	0.144*
	(0.128)	(0.071)	(0.095)	(0.082)
Information (T2 + T3)	0.074	0.026	0.073	-0.024
	(0.102)	(0.058)	(0.080)	(0.067)
Het. Variable	-0.004	-0.040	0.034	-0.050
	(0.009)	(0.089)	(0.075)	(0.076)
Het. Variable*Growth Mindset	0.011	0.184	0.095	0.093
	(0.014)	(0.140)	(0.122)	(0.121)
Het.Variable*Info Treat	-0.003	0.088	-0.043	0.200*
	(0.011)	(0.114)	(0.103)	(0.102)
Observations	9144	9144	9144	9144
R-squared	0.08	0.08	0.08	0.08

Notes: This table tests for heterogeneous treatment effects on student learning by teacher characteristics. The dependent variable across all columns is the standardized average student score across maths, English and Urdu. The column header shows the heterogeneity variable for each column. Teacher experience is a continuous variable denoting total years of teaching experience. Teacher education takes the value 1 if the teacher holds a postgraduate degree. FGL status is an indicator for whether the teacher herself has either parent who has zero years of education. Standard errors are clustered at the teacher level. *** p<0.01, **p<0.05, * p<0.1

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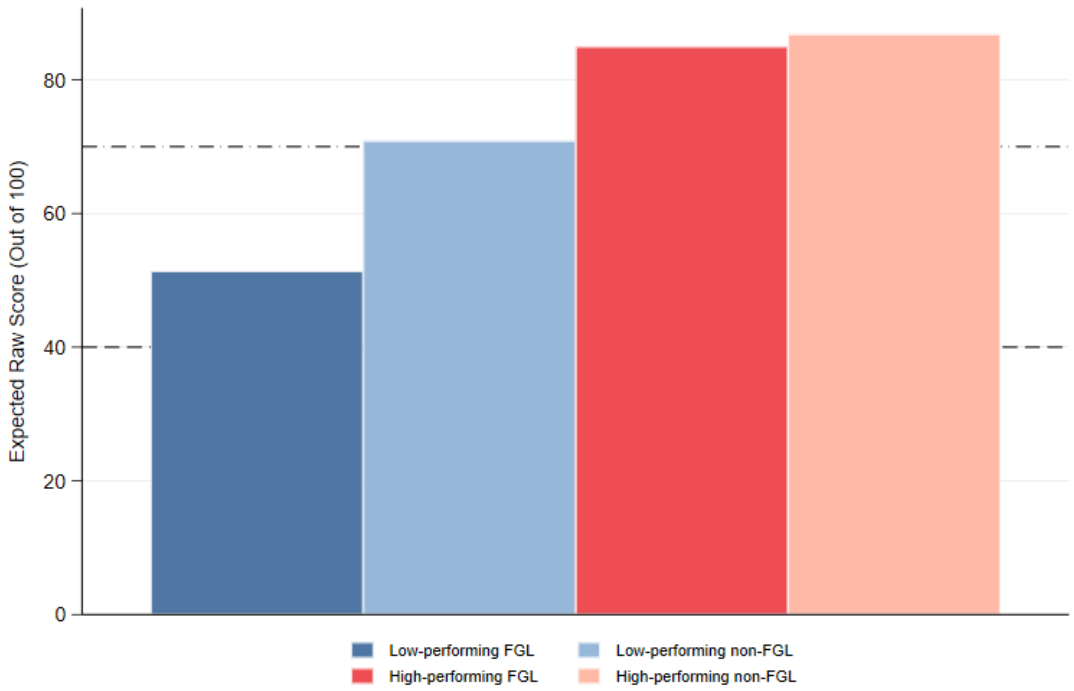
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Appendix A

Figure A1: Perceived Returns to Effort



This figure plots placebo group teachers' perceived returns to one additional hour of student effort for different student types (low- vs. high-performing; first-generation learner (FGL) vs. non-FGL), elicited using vignette questions. The vertical axis reports teachers' expected student raw score (out of 100) on the next exam. In each vignette, the student's previous score is held fixed at 40 for low-performing students and 70 for high-performing students, shown by dashed horizontal lines.

Table A1: Teacher Characteristics

	Mean	SD	Min	Max	N
Female	0.77	0.42	0	1	400
Age (years)	33.11	5.27	21	43	400
Total teaching experience (years)	8.51	4.82	1	25	400
Teaching experience in current school (years)	6.46	4.26	1	21	400
Master's degree or above	0.60	0.49	0	1	400
Teaching certification	0.23	0.42	0	1	400
Mother's education (years)	4.98	3.80	0	16	400
Father's education (years)	7.93	4.07	0	16	400
Contract teacher	0.50	0.50	0	1	400
Class size	37.67	4.58	30	45	400
More than half of students are first-generation learners	0.59	0.49	0	1	400
More than half of parents engage in child learning	0.41	0.49	0	1	400

Notes: This table presents summary statistics teachers in the study sample, based on data collected from teachers at the endline survey.

Table A2: Balance on Teacher Observables

	N	(1) Growth Mindset Mean/(SE)	N	(2) Narrative Mean/(SE)	N	(3) Evidence Mean/(SE)	N	(4) Info (Pooled) Mean/(SE)	N	(5) Placebo Mean/(SE)	(1)-(2)	(1)-(3)	(2)-(3)	(1)-(5)	(2)-(5)	(3)-(5)	(4)-(5)
											Pairwise t-test Mean difference						
Female	99	0.788	97	0.732	96	0.740	193	0.736	108	0.796	0.056	0.048	-0.008	-0.008	-0.064	-0.057	-0.061
		(0.041)		(0.045)		(0.045)		(0.032)		(0.039)							
Age (years)	99	32.828	97	32.969	96	33.552	193	33.259	108	33.111	-0.141	-0.724	-0.583	-0.283	-0.142	0.441	0.148
		(0.558)		(0.550)		(0.513)		(0.376)		(0.492)							
Total Teaching Experience (years)	99	8.121	97	8.381	96	8.771	193	8.575	108	8.750	-0.260	-0.650	-0.389	-0.629	-0.369	0.021	-0.175
		(0.495)		(0.506)		(0.484)		(0.349)		(0.452)							
Teaching Experience in Current School (years)	99	6.202	97	6.299	96	6.646	193	6.472	108	6.676	-0.097	-0.444	-0.347	-0.474	-0.377	-0.030	-0.204
		(0.444)		(0.429)		(0.427)		(0.302)		(0.411)							
Masters	99	0.576	97	0.557	96	0.688	193	0.622	108	0.583	0.019	-0.112	-0.131*	-0.008	-0.027	0.104	0.038
		(0.050)		(0.051)		(0.048)		(0.035)		(0.048)							
Teaching Certification	99	0.263	97	0.258	96	0.208	193	0.233	108	0.213	0.005	0.054	0.049	0.050	0.045	-0.005	0.020
		(0.044)		(0.045)		(0.042)		(0.031)		(0.040)							
Mother's Education	99	5.131	97	4.773	96	4.635	193	4.705	108	5.324	0.358	0.496	0.138	-0.193	-0.551	-0.689	-0.619
		(0.388)		(0.365)		(0.413)		(0.274)		(0.359)							
Father's Education	99	7.253	97	8.392	96	8.000	193	8.197	108	8.093	-1.139**	-0.747	0.392	-0.840	0.299	-0.093	0.104
		(0.406)		(0.357)		(0.426)		(0.277)		(0.427)							
Contract teacher	99	0.495	97	0.464	96	0.531	193	0.497	108	0.509	0.031	-0.036	-0.067	-0.014	-0.045	0.022	-0.012
		(0.051)		(0.051)		(0.051)		(0.036)		(0.048)							
Class Size	99	37.747	97	37.959	96	37.427	193	37.694	108	37.556	-0.211	0.320	0.532	0.192	0.403	-0.128	0.139
		(0.483)		(0.453)		(0.478)		(0.329)		(0.424)							
More than half of students are first-gen learners	99	0.586	97	0.567	96	0.562	193	0.565	108	0.639	0.019	0.023	0.005	-0.053	-0.072	-0.076	-0.074
		(0.050)		(0.051)		(0.051)		(0.036)		(0.046)							
More than half of parents engage in child learning	99	0.374	97	0.474	96	0.344	193	0.409	108	0.444	-0.100	0.030	0.130*	-0.071	0.030	-0.101	-0.035
		(0.049)		(0.051)		(0.049)		(0.035)		(0.048)							

Notes: This table presents summary statistics for teacher covariates by treatment group and tests whether there is any statistically significant difference between experimental arms at baseline. Columns (1)–(3) show the sample size and mean of each covariate for the Growth Mindset, Narrative, Evidence treatment arms, while column (4) shows the corresponding sample size and mean for the pooled information group combining Narrative and Evidence treatment arms. Column (5) reports the corresponding statistics for the placebo group, which received a financial literacy training of similar duration and format. Columns (6)–(12) present pairwise differences in means between the indicated treatment groups. Standard errors are reported in parentheses. *** p<0.01, **p<0.05, * p<0.1.

Table A3: Impact on Teacher Effort

	(1) Teaching Hours	(2) Number of Days Absent	(3) Corporal Punishment
Growth Mindset (T1)	-0.212	0.276	-0.018
	(0.381)	(0.645)	(0.145)
Narrative (T2)	-0.470*	-0.842	0.068
	(0.260)	(0.675)	(0.141)
Evidence (T3)	-0.237	0.576	0.124
	(0.316)	(0.663)	(0.149)
Observations	400	400	400
R-squared	0.09	0.12	0.15

Notes: This table reports treatment effects on teacher effort as captured using administrative data on attendance and teaching hours, as well as student reported measure for whether the teacher used corporal punishment in class. Standard errors are clustered at the teacher level. *** p<0.01, **p<0.05, * p<0.1

Table A4: Impact on Student Self-reported Stress

	(1) Stress (likert)
Growth Mindset (T1)	-0.070**
	(0.032)
Narrative (T2)	-0.048
	(0.033)
Evidence (T3)	0.003
	(0.035)
Observations	9040
R-squared	0.01

Notes: This table reports treatment effects on students' self-reported stress as measured on a likert scale. The dependent variable is standardized using the placebo group mean and standard deviation. All specifications account for school fixed effects. Standard errors are clustered at the teacher level. *** p<0.01, **p<0.05, * p<0.1

Appendix B: Implicit Association Test: Stimuli and Construction

To measure teachers' implicit associations about disadvantaged students, we administered an adapted Implicit Association Test (IAT). The task required teachers to categorize words belonging to two student-background categories and two evaluative categories. The student-background categories contrasted relatively advantaged and disadvantaged students, while the evaluative categories contrasted positive and negative attributes related to ability, effort, and student potential.

The words used in the IAT were as follows:

Implicit Association Test Stimuli

Category	**Words**
Advantaged Student	Educated parents, literate mother, literate father, rich, engaged parents, happy family
Disadvantaged Student	Uneducated parents, illiterate mother, illiterate father, poor, disengaged parents, dysfunctional family
Good	Ambitious, intelligent, quick-learner, capable, studious, able, hard-working, cultured
Bad	Unambitious, weak, slow-learner, incapable, lazy, indifferent, stupid, uncultured

The advantaged/disadvantaged distinction therefore captures parental education together with related dimensions of socioeconomic and family background. Accordingly, we interpret the IAT as measuring implicit associations toward disadvantaged students, with particular relevance to first-generation learners, rather than as a measure based exclusively on parental education.

Following the standard IAT structure, response times were compared across blocks in which disadvantaged-student words were paired with positive versus negative attributes.

Appendix C: Intervention Details and Transcript

Schedule for workshop

Start-end time	Event
	Welcome and schedule overview
	Main Presentation (with activities) led by trainer
	Group Discussion
	Writing Exercises

Session Layout Content in each session follows the following layout:

1. Activity/Ice-breaker
2. Presentation (Key headers for slides in bold text and bullet points)
3. Group discussion
4. Writing Exercise

Group Discussion: Questions to kickstart discussion:

1. How do you relate to the message?
2. Did the presentation remind you of anything similar from your experience?
3. What is one way in which you will incorporate the main message in (a) your daily life and (b) your classroom?

Writing Exercises

1. Suppose your school principal called you in his/her office and asked you about what you learnt in the training today. What would you tell him/her? Summarize key lessons and takeaways in around 200 words.
2. Compose a letter to your younger self as if you were a separate person. What are things you know now that you wish you had known earlier? Offer advice or send a message you wish you had received when you were a child or young adult. (around 200 words)

Arm A: Growth mindset training

Activity

One word that describes how you are feeling today/expectation about the training. Implemented on a jamboard where trainer shares screen and all participants see live sticky notes being added.

Presentation

Facts on education - the glass half-empty view

- ASER (2016) data on Pakistan reveals that students lag behind grades in terms of learning levels:
  - 48% of grade 5 students in rural areas are unable to read Urdu stories.
  - 54% students could not read English sentences.
  - 52% students are not able to perform a simple two-digit arithmetic division.
- Challenges on foundational literacy and numeracy
- This leads to wide heterogeneity in learning levels among students enrolled in the same grade (Muralidharan et al., 2019).
- In impoverished households, parents cannot provide the optimal learning environment for their children. With the mental struggles that come with impoverishment, the academic and creative needs of an impressionable young child will be neglected.

Challenges are inevitable

- Life is full of challenges. So is the classroom.
- Discussion: What is the one biggest challenge you face in your classroom? Ask teachers to put in their responses in the chat.
- If kids come to us from strong, healthy functioning families, it makes our job easier. If they do not come to us from strong, healthy, functioning families, it makes our job even more important.

Shifting gears, the glass half-full view

- Neuroscience tells us that the child brain is highly receptive. It is easier to learn new skills in childhood than adulthood. E.g. learning a new instrument, music lessons
- Between ages 0 and 6, the brain of a young child is very impressionable. Genetic factors influence a child's development, yes, but environmental factors have the ability to alter them. So positive influences during this period can shape the child's future in the long-term.
- The brain is like a muscle that grows stronger and smarter when it undergoes rigorous learning experiences.
- Intelligence can grow through practice at challenging tasks => it makes little or no sense to categorize individuals using labels such as "dumb" or "smart."
- Young children who experience adversity or violence back at home are not doomed to poor outcomes. They are at greater risk for adverse impacts on brain development, definitely, but they are not doomed to poor outcomes. They can actually be helped significantly if reliable and nurturing relationships are established with caregivers, such as teachers.

Dealing with challenges:

- You can't direct the wind but you can adjust the sails. You can fight it, blame it, scream about it, or you can accept it and try to put together something that's good
- There's nothing more important than attitude, and it's your choice.
- Obstacles don't have to stop you. If you run into a wall, don't turn around and give up. Figure out how to climb it, go through it, or work around it. It doesn't matter how slow you go, as long as you don't stop.
- Persistence and resilience only come from having been given the chance to work through difficult problems.
- Nine-tenths of education is encouragement.

- Life's battles don't always go to the stronger or faster individual. But sooner or later, the one who wins is the one who thinks he can.
- If a child can't learn the way we teach, maybe we should teach the way they learn
- Students don't care how much you know until they know how much you care

Examples of learners who defied odds (can choose a few):

The trainer can share the below childhood stories of Einstein, Oprah, Ben Franklin, Abdul Kalam, Edison or Lincoln without revealing their identity and ask them what they think of the particular child. Reveal later their true identity.

- Albert Einstein took three years to utter his first words and was thought to be a dud - many of his teachers thought he was lazy and wouldn't make anything of himself. He scored well in school but had questions no one could understand. He, of course, went on to develop the theory of relativity.
- Thomas Edison, similarly, was thought to be dumb and told that he would never be a success by many of his teachers because his mind would often wander in class. He went on to invent the lightbulb.
- Abraham Lincoln had very little formal education but taught himself and became a lawyer and congressman. He went on to become one of the Presidents of the USA.

Closer home, we have our own examples:

Message from role-model FGL

Exercise/activity:

- Ask all teachers to share one example from their teaching experience where they initially thought a student couldn't do it, however their continued effort led to positive results. What efforts on their part played a key role?

Arm B: Narrative about teacher value-added

Activity

Same as in arm A. The trainer asks all teachers to share one word that describes how they are feeling today or asks about expectations from the training. This is executed on a jamboard, where trainer shares screen and all participants see live sticky notes being added.

Presentation

General discussion:

- Education system comprises of students, teachers, parents, schools, government. What is our role? How do we see our role?

Role of a teacher (general quotes)

- A teacher affects eternity; you can never tell where their influence stops.
- Teachers are the most responsible and important members of society because their professional efforts affect the fate of the earth.
- Everyone who remembers his own education remembers teachers, not methods and techniques. The teacher is the heart of the educational system.
- For any person who is successful, somebody along the line gave them some help. There was a great teacher somewhere in their life.

Role of a teacher (specific pathways how teachers play a role)

- Teachers' expectations are accurate forecasts of student outcomes and affect students' educational attainment.
- Having a good teacher is conducive to a student's lifetime quality while below-average teachers can have a negative effect - because students tend to imitate or produce works similar to their actual teachers, making the quality of the teacher important in moulding the student.

Teacher-student relationship

- From the moment students enter a school, the most important factor in their success is not the colour of their skin or the income of their parents but the person standing at the front of the classroom.
- Children are inherently intuitive and curious. We, as adults, are not givers of information but facilitators who allow children to use their creativity. (Alison Gopnik)
- They may forget what you said but they will not forget how you made them feel
- Encouraging a child means that one or more of the following critical life messages are coming through, either by word or by action: I believe in you, I trust you, I know you can handle this, You are listened to, You are cared for, You are very important to me.

Role of a primary school teacher

- Builds foundation
- More points can be crowdsourced in an interactive activity

Exercise suggestions:

- Ask teachers who their favourite primary school teacher/the primary school teacher who influenced them the most was and why to show how the reasons invariably circle around to that teacher being kind with them or helping them out. Ask them if they have tried to do whatever they liked in their teacher for any of their students or what they would adopt from their teaching style.
- Tell them to close their eyes and imagine a successful professional thanking them for being their teacher and being a part of their success. Ask them how it makes them feel.
- Ask them to share anecdotes of if and when they realised teaching was more than just a job to earn a living
- Ask teachers to share one example from their experience of a student performing well after a little nudge

Optional Reading material: When Bill Gates attended Seattle's View Ridge Elementary, he was a typical nerdy 4th-grade introvert who always did his best to keep to himself. "When I first met Mrs. Caffiere, she was the elegant and engaging school librarian at Seattle's View Ridge Elementary, and I was a timid fourth grader. I was desperately trying to go unnoticed, because I had some big deficits, like atrocious handwriting and I was trying to hide the fact that I liked to read something that was cool for girls but not for boys. Mrs. Caffiere took me under her wing and helped make it okay for me to be a messy, nerdy boy who was reading lots of books." He credits Mrs. Caffiere for helping him escape his shell in the true spirit of exceptional teaching. First, she encouraged Gates' passion for reading by helping him explore it through the use of introspective questions, such as what he liked to read and why. Next, she'd go out of her way to source books that were progressively more interesting and challenging for him. Finally, once he'd read them, she would sit down with him and ask him if he liked what he had read, and more importantly, what he'd learned and why. "She genuinely listened to what I had to say," Gates recalled.

Before Maya Angelou became the powerful poet and civil rights activist the world remembers her as, she suffered a life of torment and darkness that nearly stole her voice forever. At a very young age she was forced to endure intense physical and emotional abuse at the hands of a family member. As a result, she became mute for nearly five years. It all changed one day with the help of a family friend, a teacher named Bertha Flowers. Angelou credited Mrs. Flowers for helping her find her own voice again. Through Flowers, she was introduced to African-American female artists like Frances Harper, Anne Spencer, and Jessie Fauset. In addition, Mrs. Flowers introduced Angelou to Dickens, Shakespeare, Poe, and several other prolific writers who would come to greatly influence her personal and professional philosophies.

Arm C: Evidence Treatment

Activity

Same as in arm A.

Presentation

Evidence from research:

- In the US, an education experiment called STAR was implemented. It stands for Student/Teacher Achievement Ratio. In this experiment close to 12,000 students and their teachers, across 79 schools, were randomly assigned to different classrooms in their schools between 1985 and 1989. The resultant data has been widely used to study the impacts of several factors, such as class size and teacher quality.
- The research revealed that the quality of an individual's kindergarten teacher was highly predictive of success in adulthood – affected the quality of college they go to, their college attendance, home ownership, savings, and income!
- Students' test scores are significantly impacted by the experience of their teachers - students score higher under more experienced teachers. Interestingly, later in life, they also earn more than their peers who had less-experienced teachers.
- The kindergarten classroom can affect annual earnings as much as 10%. The stakes are large.
- Mechanisms and pathways: How does kindergarten teacher matter for life outcomes? Good class quality imparts good non-cognitive traits, such as effort, initiative and lack of disruptive behaviour, to the student. These traits help the student perform well in the labour market and in their jobs. As a result, they earn well.

Exercise suggestions:

- Ask them to give examples of when they noticed a student pick up soft skills while studying or learning for tests.
- Ask them to summarize the findings in a letter to a colleague