

# **Development Economics**

## AEA Continuing Education Lectures

### **Lecture 5**

### **Education**

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January 2024

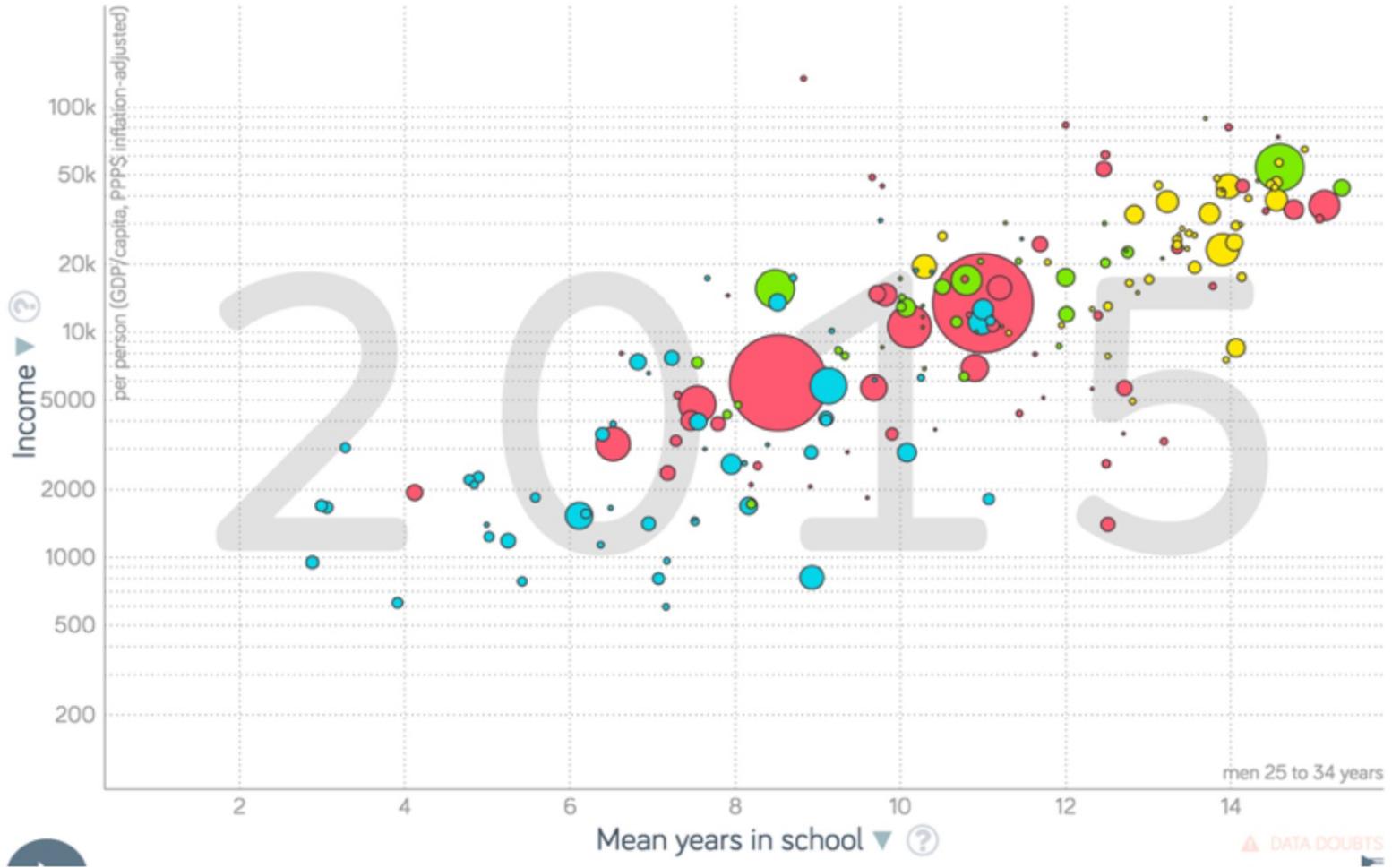
# Outline

- **Stylized Facts**
- Returns to Education
  - Traditional measures of human capital
  - Cognitive malleability
- Supply side
  - Teacher performance: Moral hazard, adverse selection, self-beliefs
  - Educational delivery: Technology, tracking
  - Private schools
- Demand side
  - Perceived returns to education
  - Parental beliefs about children

# Human Capital

- Many poor countries: education largest discretionary budget item
  - Some African countries: one third of discretionary expenditures
- What are the goals? Conceptions of human capital
  - Years of schooling
  - What you know (problem solving skills)
  - Earnings capacity (productivity)
  - Cognitive ability
  - Civic participation
  - Preferences, attitudes, beliefs (e.g. female empowerment)
  - “Non-cognitive” skills (patience, grit, reliability)

# Cross country: GDP/capita and education



# Education

## Percent of Children in School

	Female, Age:		Male, Age:	
	<u>7-12</u>	<u>13-18</u>	<u>7-12</u>	<u>13-18</u>
<b>Rural</b>				
Cote d'Ivoire	32.3%	22.8%	45.5%	21.1%
India - Udaipur	60.7%	13.0%	82.6%	24.7%
India - UP/Bihar	51.4%	20.2%	72.1%	51.2%
Indonesia	93.4%	45.9%	82.4%	39.3%
Mexico	94.5%	56.5%	93.5%	38.6%
Nicaragua	67.5%	38.0%	65.4%	27.5%
Pakistan	30.7%	9.2%	64.1%	41.3%
Panama	79.0%	14.6%	85.1%	27.0%
Papua New Guinea	53.0%	33.5%	71.4%	70.9%
Peru	94.2%	64.7%	93.3%	73.7%
South Africa	83.6%	87.5%	80.5%	76.9%
Tanzania	51.2%	53.3%	47.2%	61.4%
Timor Leste	76.6%	89.7%	80.0%	86.8%

- Large expansions in enrollment
  - Numbers likely overestimates

# High enrollment, lower attendance

## Are all children going to school in India?

### Enrollment in school

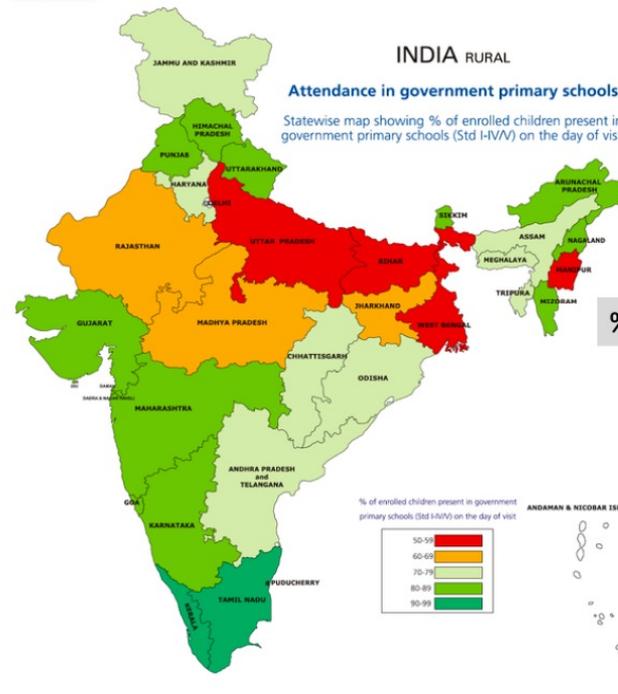
**96.7%** of children (in the age group 6-14 years) are enrolled in school in rural India.

This is the 6<sup>th</sup> year in a row that enrollment rates have been 96% or above.

### Attendance in school

Visit to a government school on any random day in September, October or November shows that about **71%** of enrolled children are attending school on that day.

However there is a lot of variation in daily attendance across states.



# Education

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- Initial focus
  - Get enrollment up – lots of progress
  - Surveys: lots of people report their kids in school
- Studies give reason for poor learning outcomes
- How do you figure it out?
- The value of data collection – an example

# Pratham (ASER) 2010

## MATH TEST / गणित SAMPLE (1)

अंक पहचान 1-9	संख्या पहचान 11-99	घटाव	भाग
3 7	65 38	$\begin{array}{r} 52 \\ - 24 \\ \hline \end{array}$ $\begin{array}{r} 76 \\ - 47 \\ \hline \end{array}$	$\begin{array}{r} 6 \overline{) 919} \\ \hline \end{array}$
1 4	92 23	$\begin{array}{r} 48 \\ - 29 \\ \hline \end{array}$ $\begin{array}{r} 75 \\ - 37 \\ \hline \end{array}$	$\begin{array}{r} 7 \overline{) 869} \\ \hline \end{array}$
8 9	47 72	$\begin{array}{r} 46 \\ - 38 \\ \hline \end{array}$ $\begin{array}{r} 31 \\ - 15 \\ \hline \end{array}$	$\begin{array}{r} 5 \overline{) 583} \\ \hline \end{array}$
5 2	56 87	$\begin{array}{r} 65 \\ - 18 \\ \hline \end{array}$ $\begin{array}{r} 23 \\ - 14 \\ \hline \end{array}$	$\begin{array}{r} 3 \overline{) 512} \\ \hline \end{array}$
पाँच पुर्रें, जिनमें 4 सही होनी चाहिए।	पाँच पुर्रें, जिनमें 4 सही होनी चाहिए।	दो करो। दोनों ही सही होने चाहिए।	एक कनकाओ जो सही होना चाहिए।

Sample:  
Arithmetic  
test

Similar tests  
developed  
in all  
languages

# Pratham (ASER) 2010

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**TABLE 6: CLASS-WISE % CHILDREN BY ARITHMETIC LEVEL  
ALL SCHOOLS 2010**

Std.	Nothing	Recognize Numbers		Subtract	Divide	Total
		1-9	11-99			
I	34.2	42.1	18.2	3.4	2.1	100
II	12.1	34.9	36.0	12.8	4.3	100
III	5.6	21.0	36.9	27.0	9.4	100
IV	2.9	11.9	27.8	35.6	21.8	100
V	2.1	7.8	19.8	34.4	35.9	100
VI	1.2	4.5	14.1	30.8	49.3	100
VII	1.0	3.2	11.5	26.5	57.8	100
VIII	0.7	2.2	8.8	21.0	67.4	100
<b>TOTAL</b>	<b>8.2</b>	<b>17.2</b>	<b>22.4</b>	<b>23.7</b>	<b>28.6</b>	<b>100</b>

# Pratham (ASER) 2010

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**TABLE 4: CLASS-WISE % CHILDREN BY READING LEVEL  
ALL SCHOOLS 2010**

<b>Std.</b>	<b>Nothing</b>	<b>Letter</b>	<b>Word</b>	<b>Level 1 (Std 1 Text)</b>	<b>Level 2 (Std 2 Text)</b>	<b>Total</b>
<b>I</b>	34.0	41.1	17.0	4.4	3.4	100
<b>II</b>	12.1	32.4	32.4	13.9	9.1	100
<b>III</b>	6.0	18.8	29.6	25.7	20.0	100
<b>IV</b>	3.1	10.1	19.4	29.3	38.1	100
<b>V</b>	2.2	6.7	12.7	25.1	53.4	100
<b>VI</b>	1.3	4.0	7.6	19.7	67.5	100
<b>VII</b>	1.0	2.7	5.2	15.0	76.2	100
<b>VIII</b>	0.7	1.9	3.2	11.3	82.9	100
<b>TOTAL</b>	8.3	15.9	16.8	18.2	40.9	100

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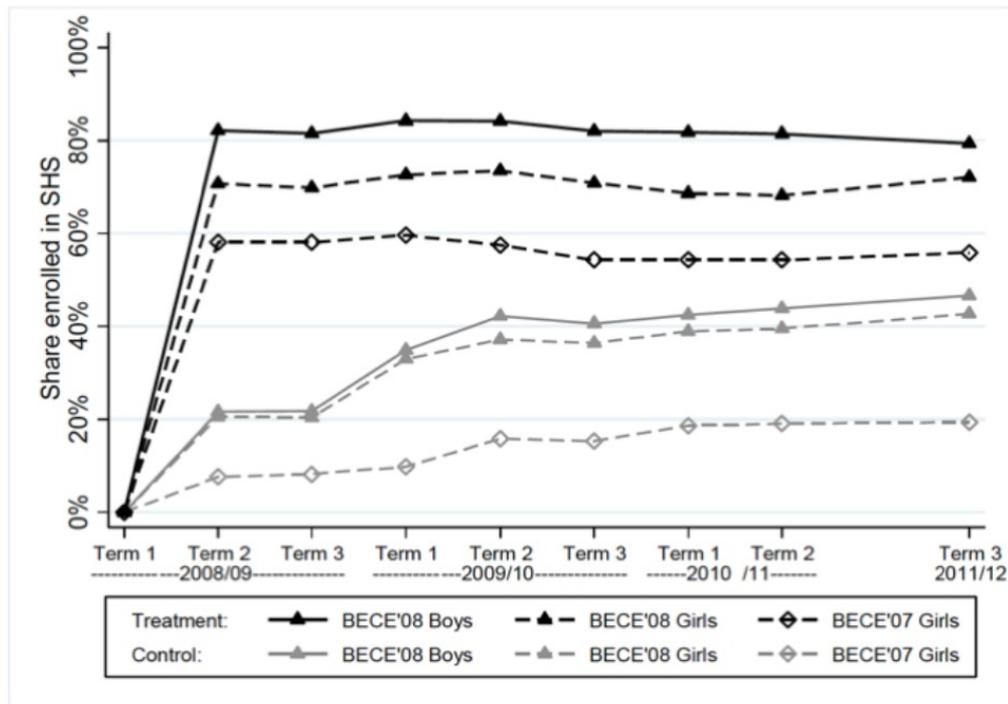
# Returns to Schooling?

- Why do we care about this?
- What are the relevant outcomes?
- The challenge of causal inference

# Duflo Dupas Kremer

- Scholarships randomly assigned to students who qualified for secondary school on the basis of a competitive test but who had not yet joined (Ghana)

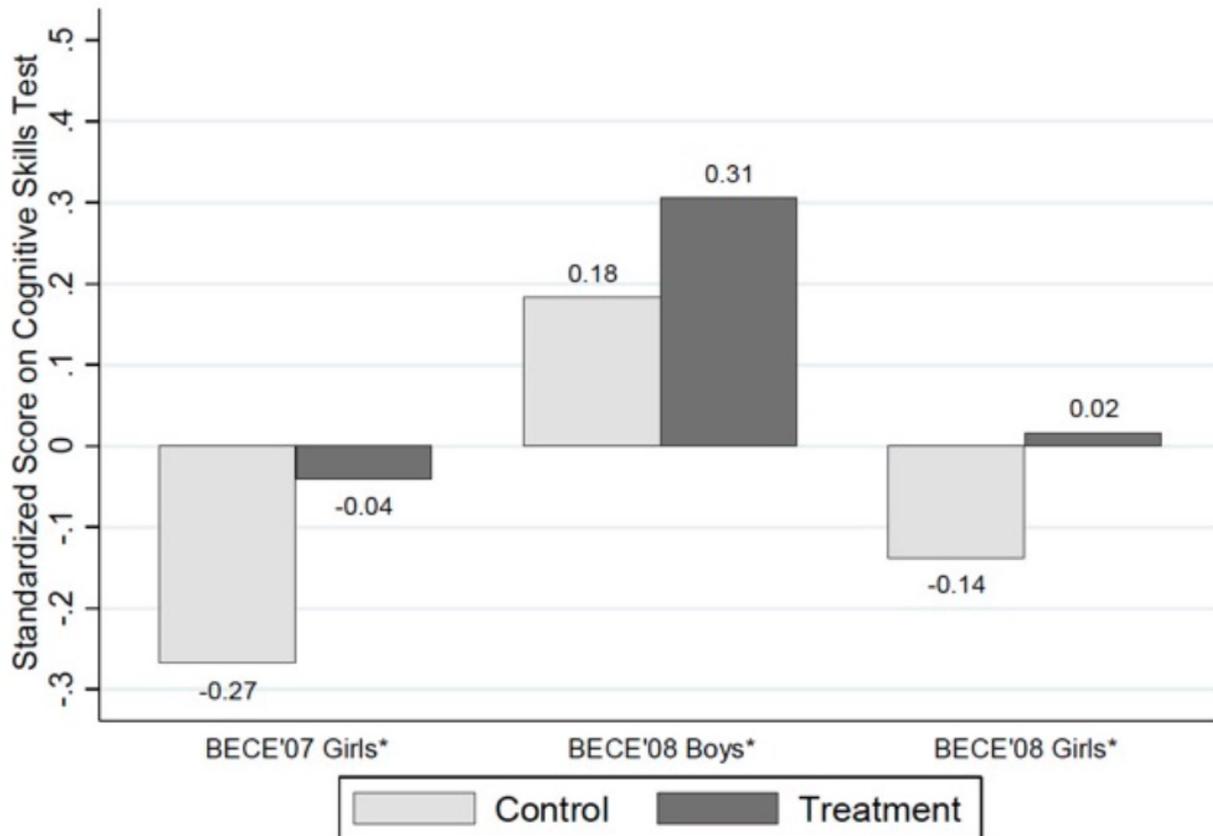
Figure 1: Impact of Scholarship on Share Enrolled in SHS



# Duflo Dupas Kremer

Figure 3: Effect of Scholarship Treatment on Cognitive Skills after 5 years (2013)

Panel A. by gender and cohort



# Education

Table 6: Labor Market Outcomes

	Combined			Academic Major Admits			Vocational Major Admits		
	All	Female	Male	All	Female	Male	All	Female	Male
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<u>Panel A. Earnings</u>									
<u>Inv. hyperbolic sine earnings (2016)</u>									
Treatment effect	0.308	0.383	0.177	0.019	0.213	-0.269	0.505	0.498	0.482
Standard error	(0.145)**	(0.198)*	(0.197)	(0.227)	(0.311)	(0.310)	(0.187)***	(0.257)*	(0.255)*
Comparison mean	3.214	2.413	4.054	3.143	2.313	4.047	3.263	2.484	4.059
p-value on equality of effects	<i>(5)=(6)=(8)=(9): .211 (2)=(3): .460</i>			<i>(5)=(6): .273</i>			<i>(4)=(7): .099*</i>	<i>(8)=(9): .965</i>	
<u>Log earnings last month if positive (2016)</u>									
Treatment effect	-0.019	0.049	-0.064	-0.059	0.109	-0.177	0.006	0.012	0.005
Standard error	(0.060)	(0.093)	(0.077)	(0.099)	(0.151)	(0.125)	(0.077)	(0.117)	(0.097)
Comparison mean	5.066	4.792	5.251	5.053	4.761	5.252	5.074	4.812	5.250
p-value on equality of effects	<i>(5)=(6)=(8)=(9): .482 (2)=(3): .348</i>			<i>(5)=(6): .144</i>			<i>(4)=(7): .603</i>	<i>(8)=(9): .964</i>	
<u>Positive earnings (2016)</u>									
Treatment effect	0.055	0.063	0.039	0.007	0.028	-0.028	0.088	0.087	0.085
Standard error	(0.025)**	(0.034)*	(0.034)	(0.039)	(0.053)	(0.053)	(0.032)***	(0.044)**	(0.044)*
Comparison mean	0.556	0.441	0.679	0.545	0.424	0.678	0.564	0.452	0.679
p-value on equality of effects	<i>(5)=(6)=(8)=(9): .299 (2)=(3): .610</i>			<i>(5)=(6): .450</i>			<i>(4)=(7): .105</i>	<i>(8)=(9): .980</i>	
<u>Total earnings last month (GHX) (2016)</u>									
Treatment effect	7.656	5.132	6.216	-19.199	-6.732	-38.617	25.921	13.097	36.492
Standard error	(10.993)	(15.176)	(15.068)	(17.283)	(23.815)	(23.722)	(14.244)*	(19.678)	(19.501)*
Comparison mean	134.854	82.022	190.202	136.261	79.106	198.471	133.887	84.090	184.703
p-value on equality of effects	<i>(5)=(6)=(8)=(9): .094* (2)=(3): .959</i>			<i>(5)=(6): .342</i>			<i>(4)=(7): .044**</i>	<i>(8)=(9): .398</i>	

- Increase in earnings: concentrated in vocational training
- Also decreases in fertility for women

# Other Estimates

- Duflo – Indonesia school construction
  - Each new school per 1,000 children:
  - Increase in education of 0.12 to 0.19 years
  - Increase in wages of 1.5 to 2.7 percent
- Ozier – RD on passing secondary school admissions exam
  - Barely pass vs. barely fail the secondary school admissions exam
  - Increases secondary school completion by 15 percentage points
  - Shift out of self-employment, into formal employment
  - Decrease in teen pregnancy

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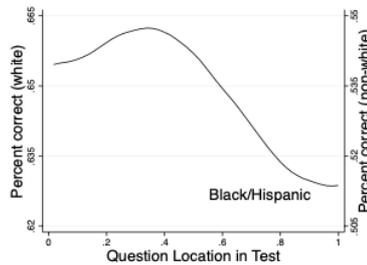
# Brown, Kaur, Schofield (QJE 2024)

- Long-held views on how schooling may affect cognition
  1. Learning academic content and skills (e.g. literacy, problem solving)
  2. Capacity to engage in cognition itself (e.g. undertake effortful thinking)
- 2nd possibility: More expansive view of how education shapes general human capital
- Specific feature of schooling: Effortful thinking for continuous stretches of time
- Investigate effects on one particular mental capacity: Cognitive endurance

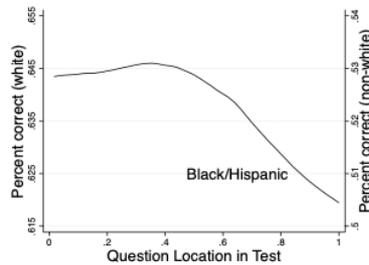
# Brown, Kaur, Schofield (QJE 2024)

Motivation: Large declines in performance over time

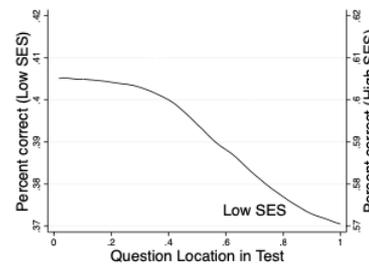
## TIMSS Exam



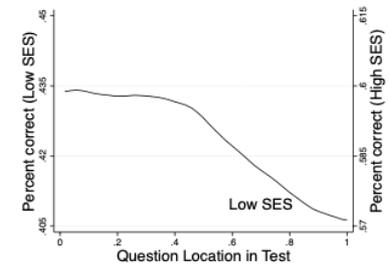
(a) Math (US)



(b) Science (US)



(c) Math (global)



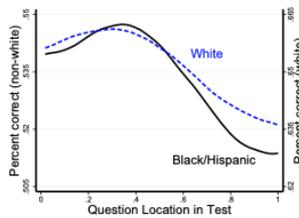
(d) Science (global)

- TIMSS: Administered to 4th graders during school day (36 mins per subject)
- Question order randomized, ample time to finish test (< 2% of students don't finish)
- Performance decline across subjects: 12% globally, 6% in US

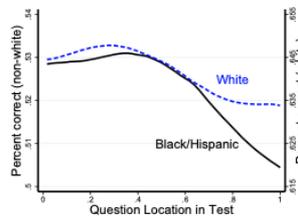
# Brown, Kaur, Schofield (QJE 2024)

## Systematic SES heterogeneity across tests and subjects

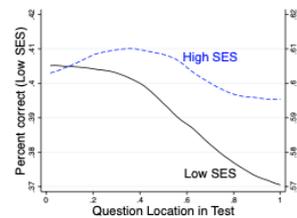
### TIMSS Exam



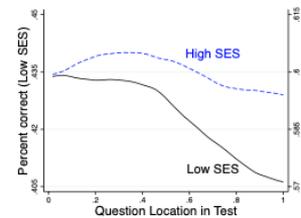
(a) Maths (US)



(b) Science (US)

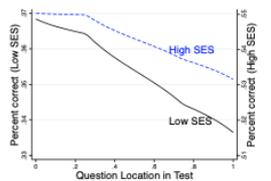


(c) Maths (global)

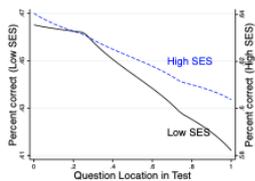


(d) Science (global)

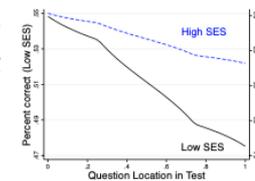
### PISA Exam



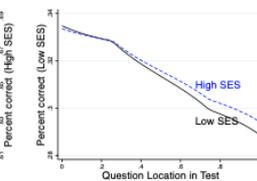
(e) Maths (US)



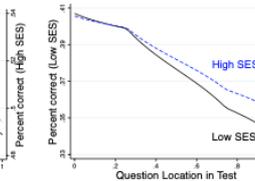
(f) Science (US)



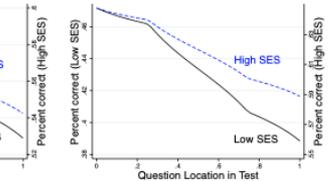
(g) Reading (US)



(h) Maths (global)



(i) Science (global)



(j) Reading (global)

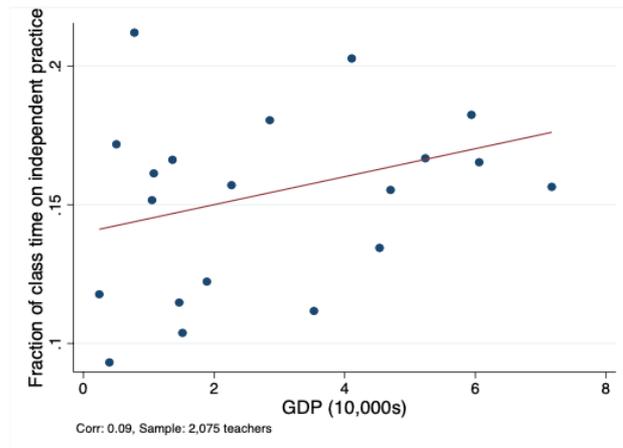
- Large differences: 30-200% more decline among low SES students
- Accounts for 10% of test score gap between Blacks/Hispanics and Whites in the U.S.

# Brown, Kaur, Schofield (QJE 2024)

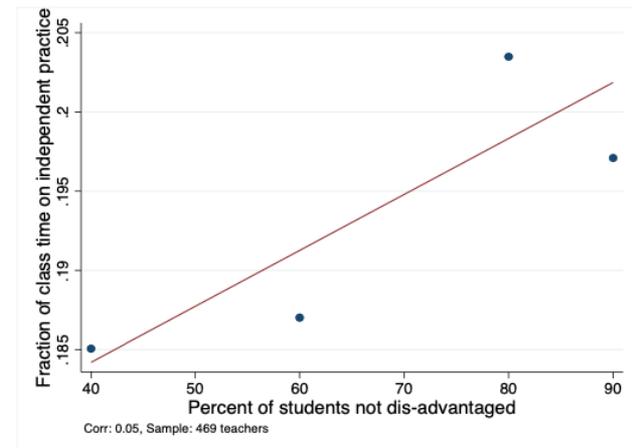
## Motivation: Does schooling have relevance for attentional practice?

- Psychology literature: "train" sustained attention by practicing focus
- TIMSS teacher time use survey: do students "practice material on their own"?

### Global Sample



### US Sample



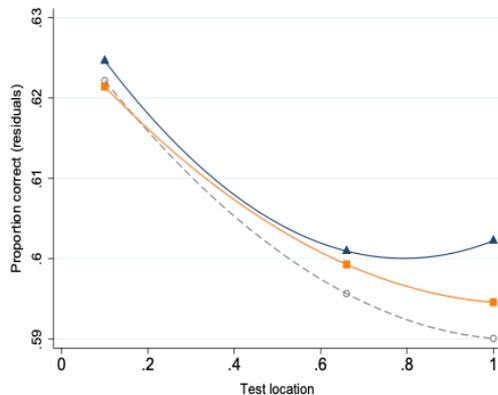
- High income students spend 40% more time in independent practice

# Brown, Kaur, Schofield (QJE 2024)

- RCT with private schools in UP, India
- Randomize 8-10 hours of cognitive practice in 20 mins increments
  - Math practice (mimics what good schooling does)
  - Games practice (stronger test: attentional practice, devoid of all content)

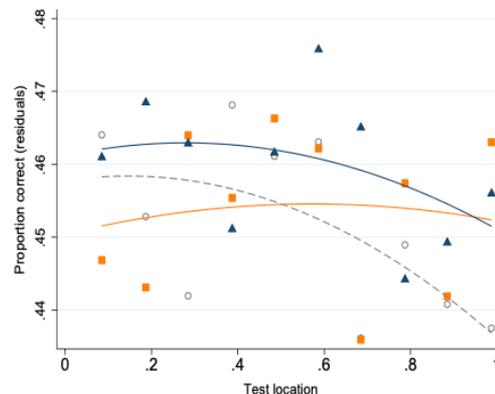
## Performance declines

### Listening



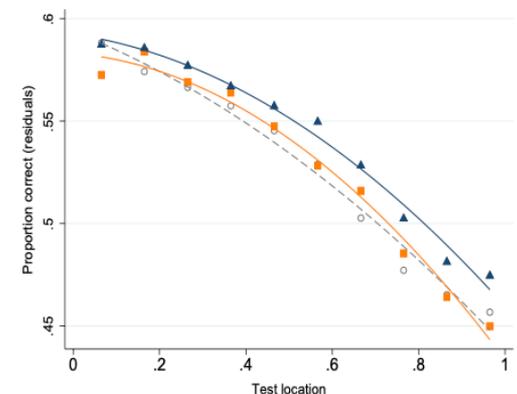
Decline reduction: 17% (pval 0.041)  
Quintile 1 effect: -0.0013 (pval 0.845)

### Ravens Matrices



Decline reduction: 33% (pval 0.031)  
Quintile 1 effect: -0.0050 (pval 0.617)

### Math



Decline reduction: 14% (pval 0.014)  
Quintile 1 effect: -0.0088 (pval 0.333)

○ Control    ■ Games Practice    ▲ Math Practice

# Brown, Kaur, Schofield (QJE 2024)

- Substantive test score gains on unrelated subjects (recall 8-10 hours)
- Spending time in effortful thinking (devoid of subject content) improves ability to accumulate traditional human capital

	<b>Dependent Variable: Z-score of Student's Grades</b>				
	<i>Subject:</i>	All (1)	Non-Math (2)	Hindi (3)	English (4)
<b>Panel A: Pooled Treatment Arms</b>					
Cognitive Practice	0.0897** (0.0348)	0.0923** (0.0386)	0.0989** (0.0393)	0.0919** (0.0407)	0.0849** (0.0377)
<b>Panel B: Disaggregated Treatment Arms</b>					
Math Practice	0.0916** (0.0402)	0.0926** (0.0445)	0.0962** (0.0452)	0.0978** (0.0471)	0.0902** (0.0437)
Games Practice	0.0877** (0.0399)	0.0920** (0.0444)	0.1015** (0.0453)	0.0860* (0.0469)	0.0795* (0.0428)
p-value: Math Practice = Games Practice	0.9232	0.9899	0.9063	0.8013	0.7999
Observations	11320	7539	3780	3759	3781

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# Teacher Absenteeism is Huge Problem

## Provider Absence Rates by Country and Sector

	<i>Absence rates (%) in</i>	
	<i>Primary schools</i>	<i>Primary health centers</i>
Bangladesh	16	35
Ecuador	14	—
India	25	40
Indonesia	19	40
Peru	11	25
Uganda	27	37
<b>Unweighted average</b>	<b>19</b>	<b>35</b>

*Notes:* Providers were counted as absent if they could not be found in the facility for any reason at the time of a random unannounced spot check (see text for further detail). In Uganda, the sampled districts

# Moral Hazard: Performance Pay

- Muralidharan Sundararaman (JPE 2011): incentivize test score gains

$$\text{Bonus} = \begin{cases} \text{Rs. } 500 \times (\% \text{ gain in average test scores} - 5\%) & \text{if gain} > 5\% \\ 0 & \text{otherwise.} \end{cases}$$

TABLE 3  
IMPACT OF INCENTIVES ON STUDENT TEST SCORES  
Dependent Variable: Normalized End-of-Year Test Score

	YEAR 1 ON YEAR 0		YEAR 2 ON YEAR 0	
	(1)	(2)	(3)	(4)
A. Combined (Math and Language)				
Normalized lagged test score	.503*** (.013)	.498*** (.013)	.452*** (.015)	.446*** (.015)
Incentive school	.149*** (.042)	.165*** (.042)	.219*** (.047)	.224*** (.048)
School and household controls	No	Yes	No	Yes
Observations	42,145	37,617	29,760	24,665
R <sup>2</sup>	.31	.34	.24	.28

- Mbiti: cross-randomize performance pay with cash grants to schools (Kenya)
  - Evidence for complementarity between incentives and resources
- de Ree et al. (QJE 2018): no impacts of *unconditional* salary increase (Indonesia)
  - higher satisfaction, no performance improvement (absenteeism, test scores, etc)

# Brown (WP 2023)

- Adverse selection: If payment based on performance, do better teachers select in?
- RCT with large private school chain in Pakistan
- Ask teachers if they would prefer performance pay or flat pay contract
- Teachers with higher value added prefer performance pay
- Teachers have more information about their type than principals → power of self-selection

Table 2: Teacher Value-Added by Contract Choice

	Teacher Baseline Value-Added (in Student SDs)			
	(1)	(2)	(3)	(4)
Chose Performance Pay	0.0485** (0.0207)	0.0450** (0.0207)	0.0452** (0.0218)	0.0387* (0.0221)
Principal Rating of Teacher		0.0210** (0.0104)		0.0202* (0.0105)
Observations	1284	1284	1284	1284
Performance Metric	Objective	Objective	Subjective	Subjective
Control Mean	-0.0283	-0.0283	-0.0284	-0.0284
Control SD	0.349	0.349	0.345	0.345

# Jalnidh Kaur (WP 2024)

- Teacher self-beliefs: many perceive low returns to effort

**Table 1:** *Distribution of teachers' responses to belief statements*

	Strongly Disagree	Disagree	Agree	Strongly Agree
<i>The amount a student can learn is primarily related to family background.</i>				
India	4.46	43.87	49.44	2.23
Ethiopia	4.30	14.45	59.38	21.88
<i>I am very limited in what I can achieve because a student's home environment is a large influence on his/her achievement</i>				
India	2.59	34.81	60.01	2.59
Ethiopia	3.91	32.81	45.70	17.58
<i>Even a teacher with good teaching abilities may not make a difference for many students.</i>				
India	14.10	46.56	35.08	3.93
Ethiopia	10.08	34.11	39.53	16.28

*Notes:* Data from Young Lives school survey (India and Ethiopia, 2016-17). The surveys covered 281 teachers across 205 schools in India, and covered 271 teachers across 63 schools in Ethiopia. The schools

# Jalnidh Kaur (WP 2024)

- Self-beliefs intervention (targeting self-efficacy)
- Large increases in teacher effort, and also student test scores

**Table 8:** *Treatment Effect on Teachers' In-Class Effort*

	(1) Pooled Index	(2) Materials and Content	(3) Classroom Climate	(4) Engagement	(5) Accessibility	(6) Demeanor	(7) Pedagogical Practices
Treat	0.129** (0.065)	0.120** (0.058)	-0.013 (0.068)	0.189*** (0.055)	0.091 (0.069)	0.057 (0.069)	0.148** (0.061)

**Table 11:** *Treatment Effects on Student Learning*

	Standardized Math Scores		
	(1)	(2)	(3)
Treat	0.091** (0.045)	0.101** (0.046)	0.094* (0.048)
Pre-mid score	0.768*** (0.017)	0.769*** (0.017)	0.509*** (0.022)
Previous year score			0.436*** (0.022)
Controls	No	Yes	Yes
Strata FE	Yes	Yes	Yes
Observations	6941	6941	6941
R-squared	0.50	0.50	0.57

# Outline

- **Stylized Facts**
- Returns to Education
  - Traditional measures of human capital
  - Cognitive malleability
- Supply side
  - Teacher performance: Moral hazard, adverse selection, self-beliefs
  - **Educational delivery: Technology, tracking**
  - Private schools
- Demand side
  - Perceived returns to education
  - Parental beliefs about children

# Educational Delivery: Technology

- Background:
  - Use technology to supplement learning in classroom
  - One laptop per child: generally perceived as not effective
  - Not enough to put in hardware: software (content) is key
  - Takes pressure off teacher performance, adapt to heterogeneous student skill, practice
- Banerjee, Cole, Duflo, Linden (QJE 2007)
  - Computer-based math games: play in pairs in computer lab
  - 0.47 SD gain in math attainment at end of year
- Muralidharan, Singh, Ganimian (AER 2019)
  - Adaptive computer-based after-school practice
  - 0.6 SD gain in Math, 0.39 SD gain in Hindi
- Brown, Kaur, Schofield (QJE 2024)
  - Adaptive math practice problems during elective / free periods (8-10 hours)
  - 0.09 SD gain in endline math scores

# Recall: Heterogeneous Ability within Class

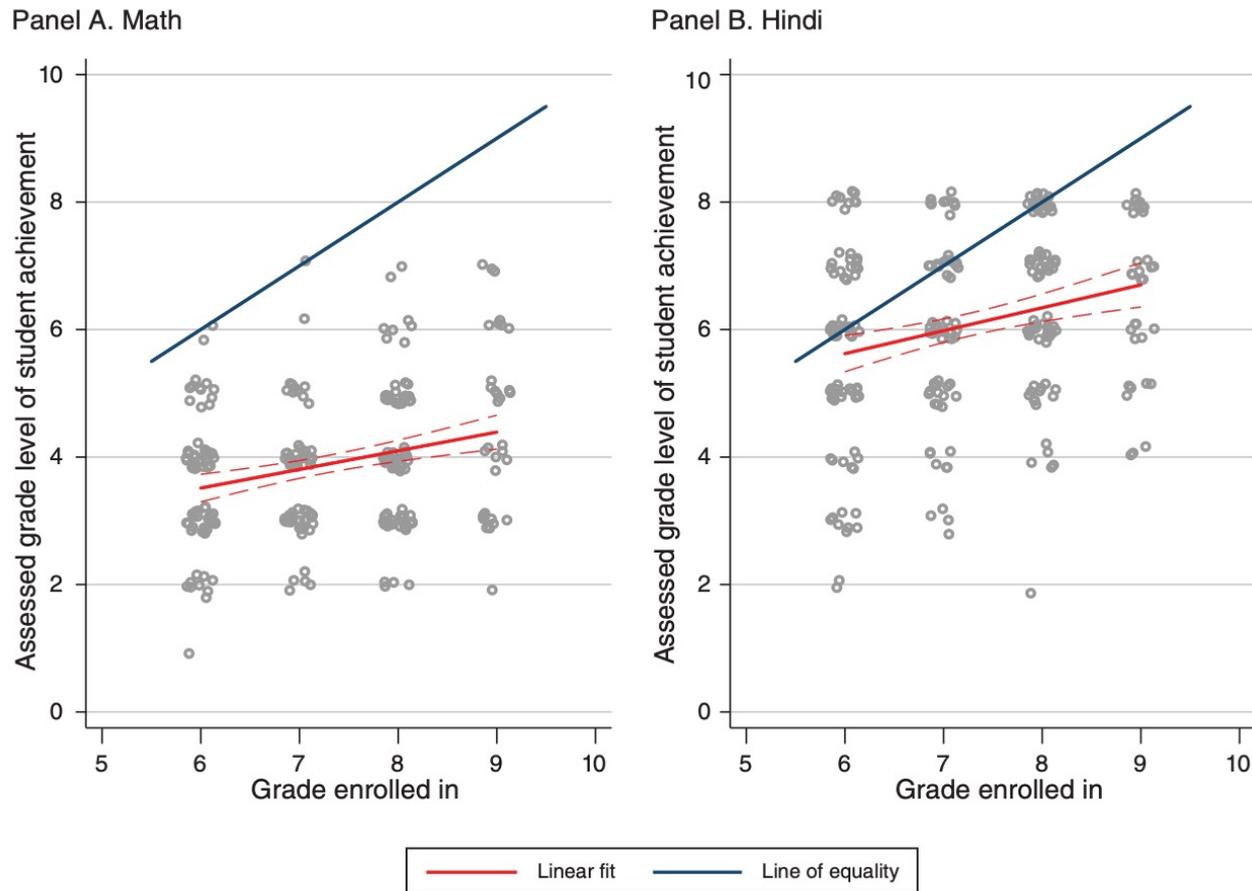


FIGURE 1. ASSESSED LEVELS OF STUDENT ACHIEVEMENT VERSUS CURRENT GRADE ENROLLED IN SCHOOL

Source: Muralidharan et al.

# Educational Delivery: Tracking

- Another approach to deal with heterogeneous quality
- Tracking: controversial
  - Allow teachers to target students at their level
  - Remove positive peer effects amongst students
- Duflo, Dupas, Kremer (2011): RCT with primary schools in Kenya

TABLE 2—OVERALL EFFECT OF TRACKING

	Total score				Math score		Literacy score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A. Short-run effects (after 18 months in program)</i>								
(1) Tracking school	0.139 (0.078)*	0.176 (0.077)**	0.192 (0.093)**	0.182 (0.093)*	0.139 (0.073)*	0.156 (0.083)*	0.198 (0.108)*	0.166 (0.098)*
(2) In bottom half of initial distribution × tracking school			−0.036 (0.07)		0.04 (0.07)		−0.091 (0.08)	

- Policy diffusion: Teaching at the Right Level

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# Competition and Private Schools

- Wide prevalence of private schools in developing countries
  - Multiple private school options along with public schools
- Andrabi et al. (WP 2023)
  - Randomized provision of grants to government schools in Pakistan
  - Impact of grants: 0.2 SD increase in attainment in government schools
  - Competition effect: 0.2 SD increase in attainment in private schools in same market
  - Concentrated in more competitive local markets
- Andrabi Das Khwaja (AER 2017)
  - Give parents info about school performance in Pakistan
  - Increased test scores by 0.11 SD, decreased private school fees by 17%, increased primary enrollment by 4.5 %
  - Role of asymmetric info and hard institutional environment in poor countries

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# Beliefs: Returns to Education

- Low income people may lack information (lack of role models, etc)
- Jensen (QJE 2010): Misperceptions about the returns to education
  - 8<sup>th</sup> grade boys in Dominican Republic
  - Low perceived returns to secondary school
  - In some schools, tell students average earnings differences by school completion
  - Impacts: 0.25-0.35 additional years of schooling over next four years
  - One of the most cost effective interventions ever! Does it replicate?
- Jensen (QJE 2012): Does education respond to the returns to education?
  - Randomize recruiting services for BPO jobs in Indian villages for 3 years
  - Increases information / salience of job market opportunities
  - Large impacts on women
  - Less likely to get married or have children; enter labor market, increase schooling
  - Report wanting fewer children, and higher desire to work throughout lifetime

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# Beliefs: Child Ability

- Beliefs about child ability will affect willingness to invest in education
- Dizon-Ross (AER 2019)
  - Parents have inaccurate beliefs about child performance
  - Clear, digestible performance information: update beliefs
  - Investments: enrollment goes up (down) for high (low) performers; input mix
  - Clever measurement trick: allocation of high school scholarship lottery
- Duhon (WP 2024)
  - Low income parents seem to be too pessimistic about child ability

