

# National Differences in an International Classroom


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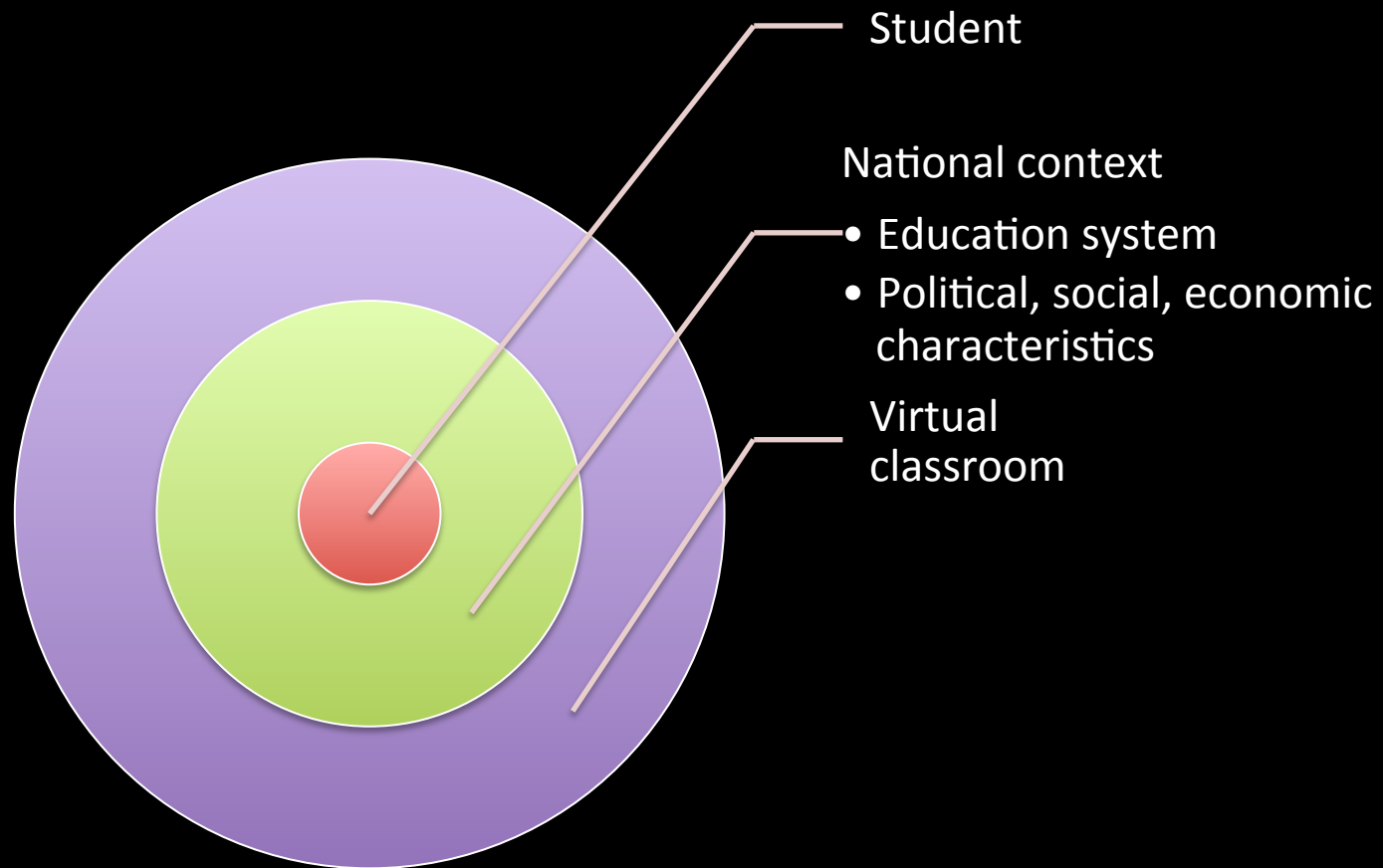
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& Learning  
Laboratory



Massachusetts  
Institute of  
Technology

- 
1. Background on 6.002x
  2. Student demographics
  3. Differences in behaviors and outcomes
  4. Predictive modeling

# Students are nested within a country context



## Need to understand interaction between virtual classroom and real-world context

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Therefore, we ask:

- Who are the students?
- What are their behaviors and outcomes?
- Which individual and contextual factors predict higher achievement?
- *How can international policymakers use such tools as a vehicle for increased access to educational opportunity?*



ACCESS

EQUITY

The image features a solid dark blue background. In the top-left corner, there is a white L-shaped line consisting of a vertical segment and a horizontal segment that meet at a right angle. The word "Background" is centered in the lower half of the image in a white, sans-serif font.

Background

# “Circuits and Electronics” (6.002x)

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- First MOOC offered by MIT
- March to June 2012

In-depth analysis of one class to inform the xMOOC “classroom” context and its analysis

*This project is supported by NSF grant No. DRL-1258448*

# 6.002x course site

## Background

### Courseware Index

Overview

#### Week 1

Administrivia and Circuit Elements  
Lecture Sequence

Circuit Analysis Toolchest  
Lecture Sequence

Basic Circuit Analysis  
Homework due March 18

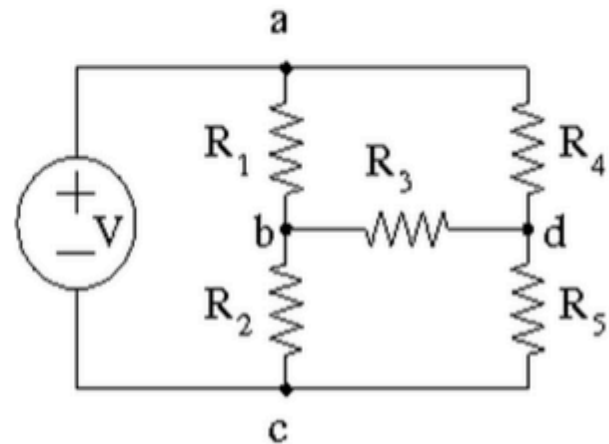
Resistor Divider  
Lab due March 18

Week 1 Tutorials  
Tutorial Index

Week 2

### S2E1: CIRCUIT TOPOLOGY

In the bridge network shown:





# Variety of resources available

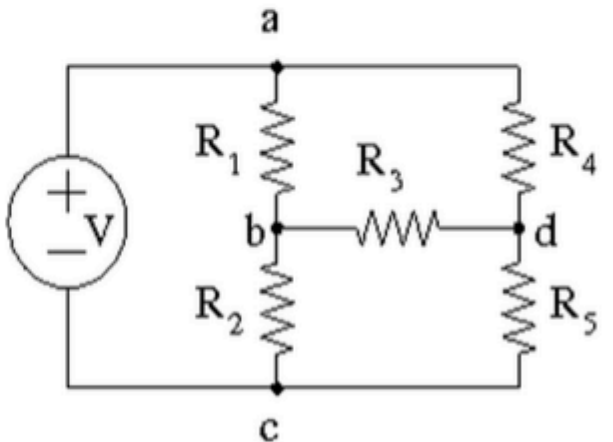
## Background

**Courseware Index**

- Overview
- Week 1**
  - Administrivia and Circuit Elements
  - Lecture Sequence
  - Circuit Analysis Toolchest**
    - Lecture Sequence
  - Basic Circuit Analysis
    - Homework due March 18
  - Resistor Divider
    - Lab due March 18
  - Week 1 Tutorials
    - Tutorial Index
- Week 2

**S2E1: CIRCUIT TOPOLOGY**


In the bridge network shown:



- “Khan Academy-like” videos
- Questions between video segments
- Tutorials
- Discussion forum
- Wiki
- Assessments (problem sets, labs, midterm, final)

# Data overview

- Clickstream data
  - **230 million** interactions
  - IP addresses, interactions with course components, assignments and exams
- Threads on discussion forum
  - **12,696** threads **96,696** posts
  - Questions, answers, or comments
- End-of-course survey
  - **7,000+** [matrix sample]

A red L-shaped line is positioned on the left side of the slide. It consists of a vertical line segment and a horizontal line segment that meet at a right angle, forming a corner bracket that frames the text on the right.

Individual students'  
backgrounds: general  
demographics

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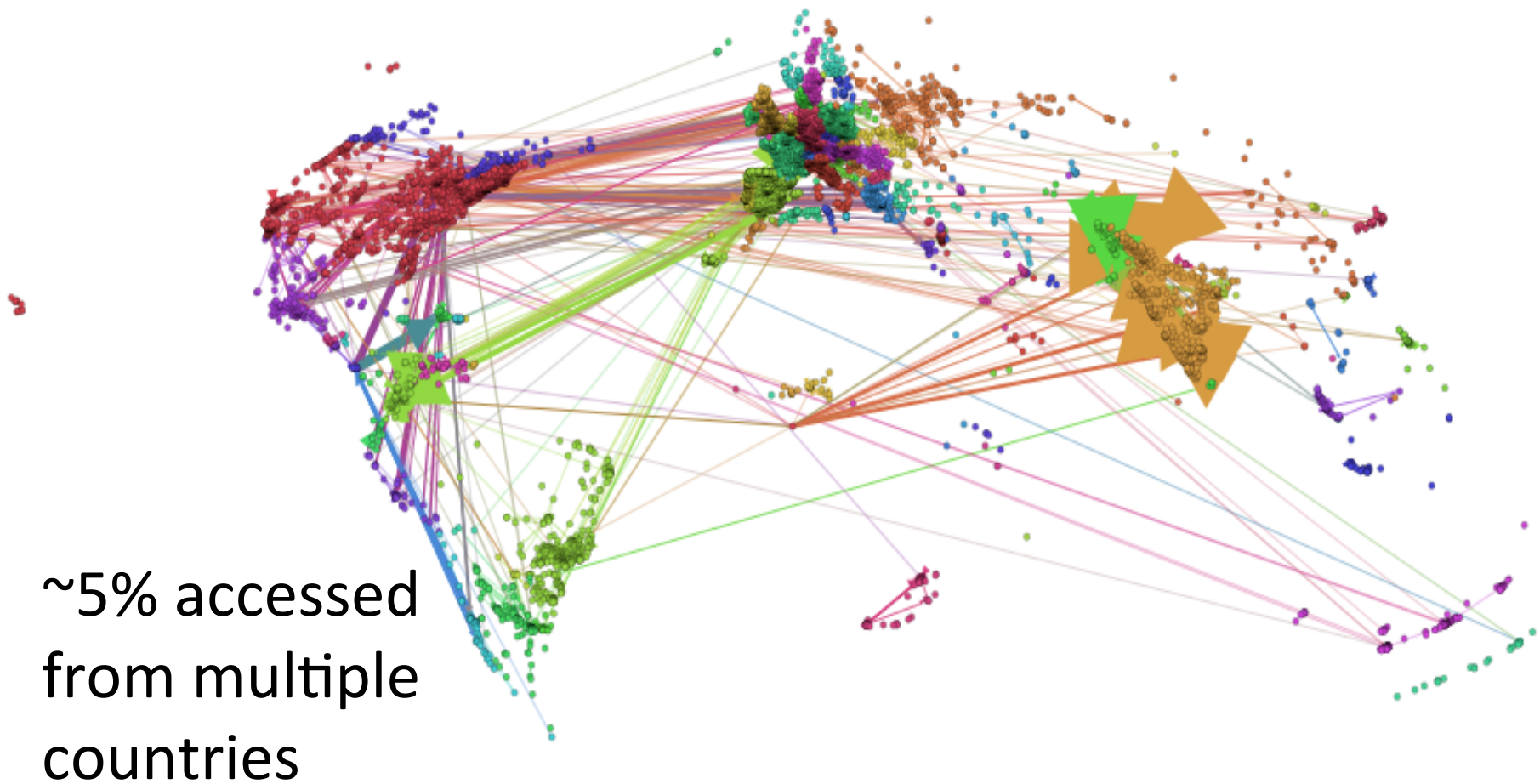
Who is accessing this MOOC?

- Where are they from?
- Have they had access to these materials before?
- What are their individual goals?

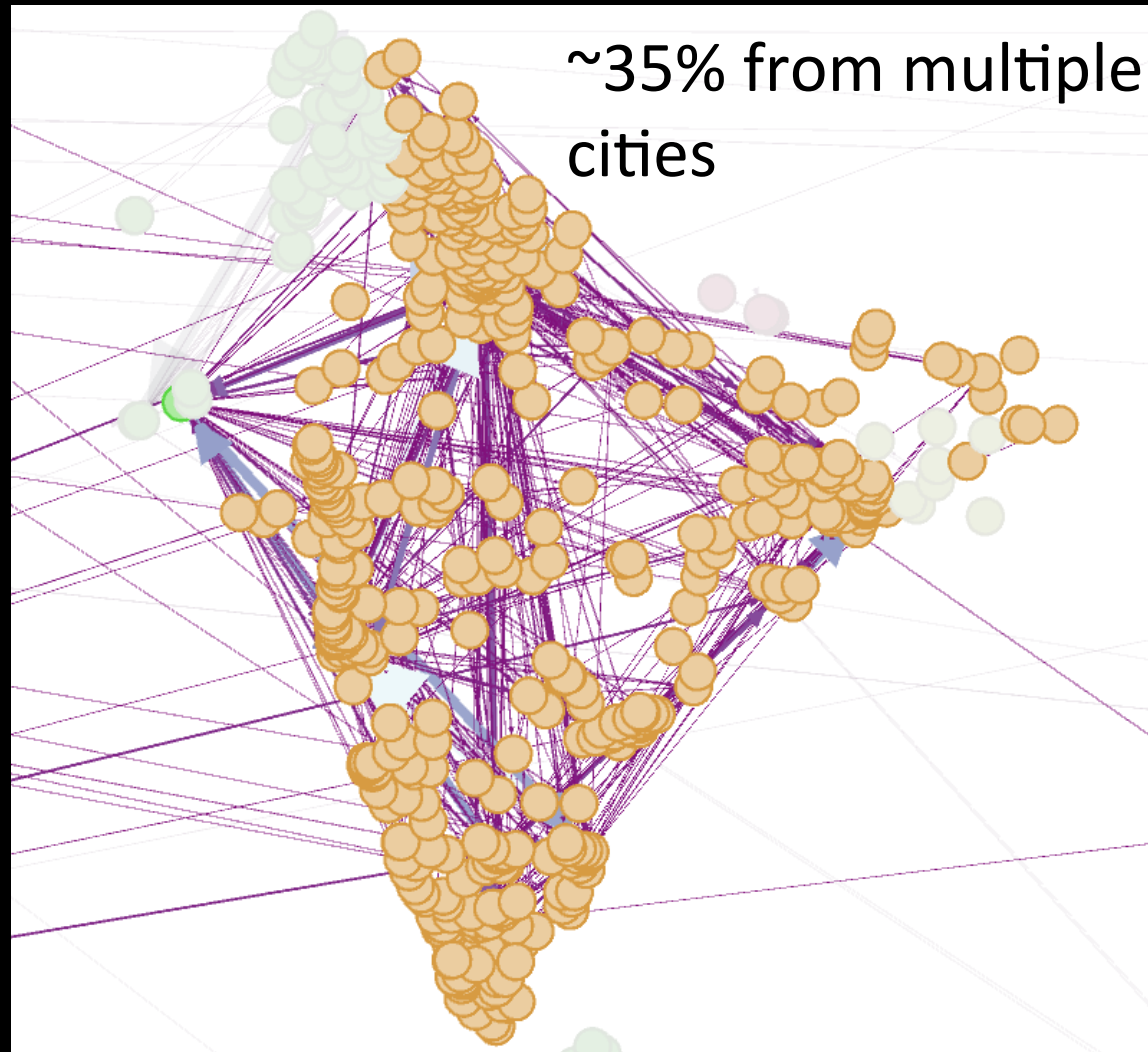
# Student locations



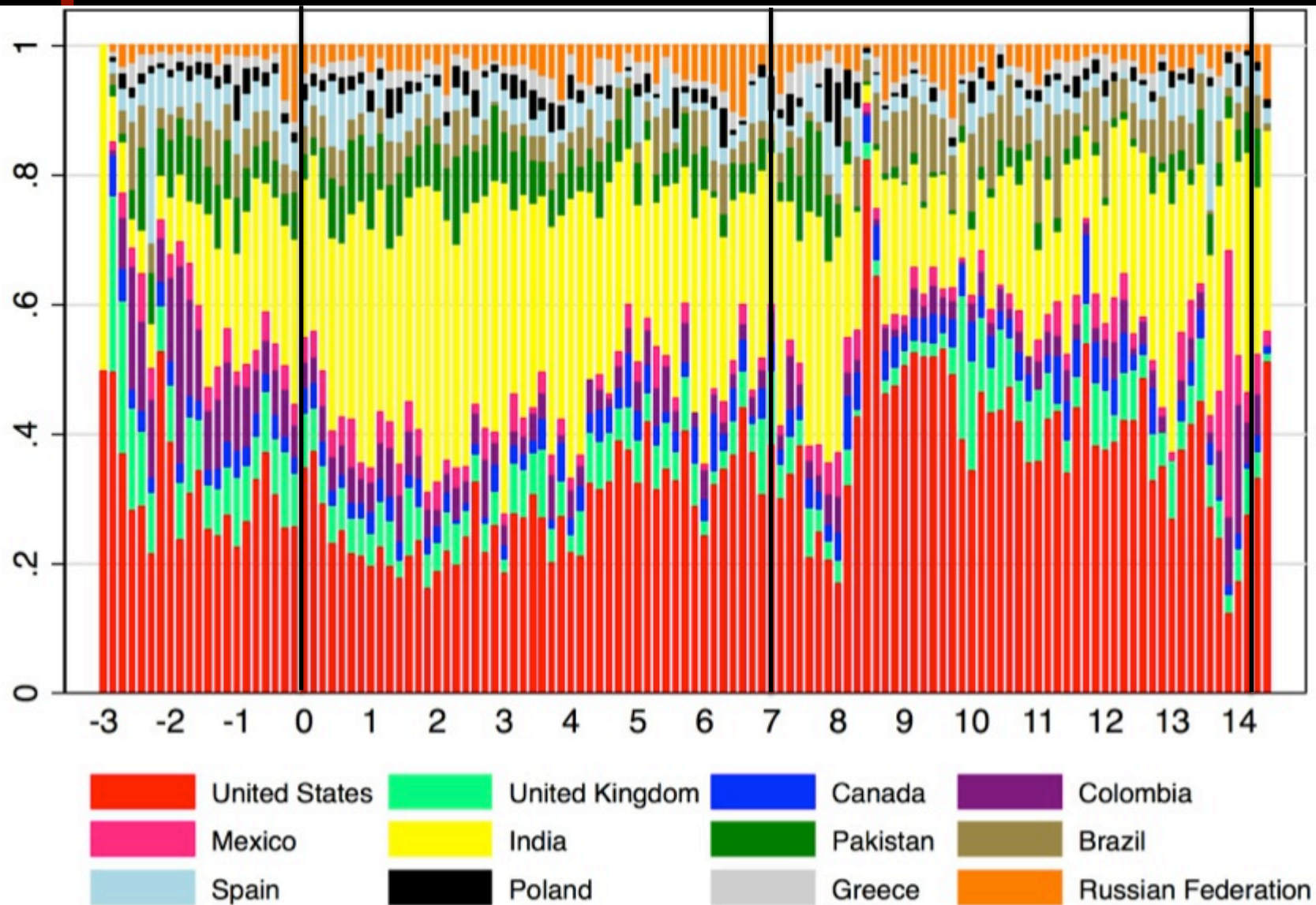
# Mobile students



# Travelers within India

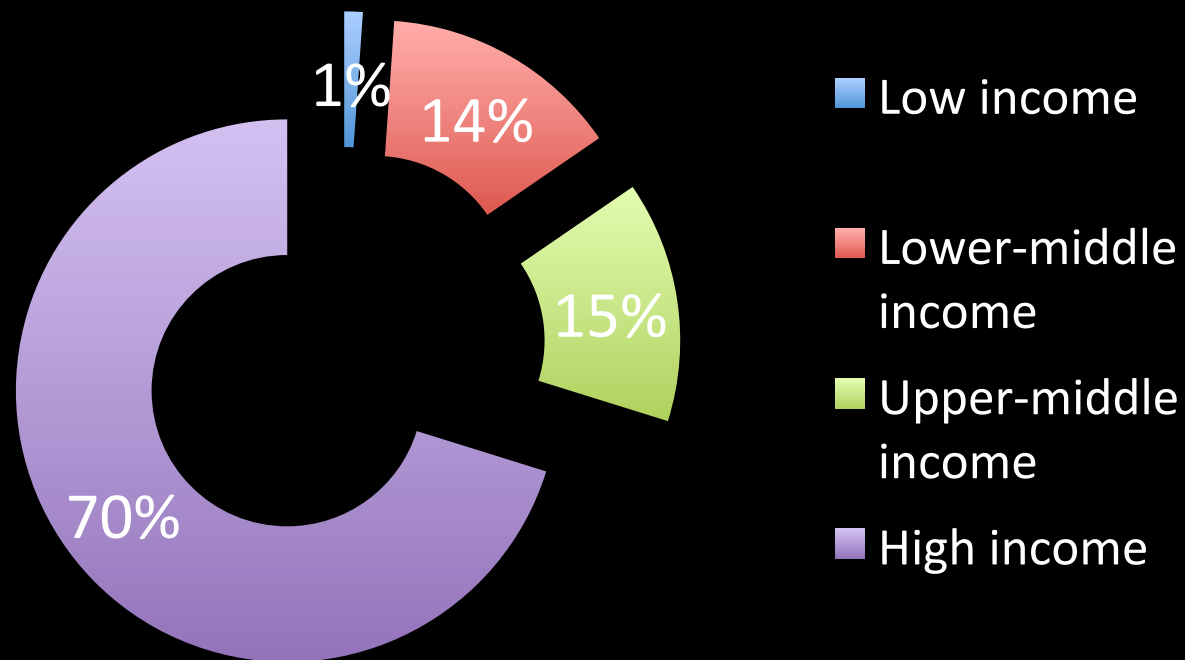


# Registration waves





# National context



National per capita income level

# National context

## Urbanicity (city size)

■ Below 100k ■ 100k - 250k ■ 250k - 500k ■ 500k - 1m ■ 1m - 5m ■ 5m - 10m ■ >10m

37.75

9.15

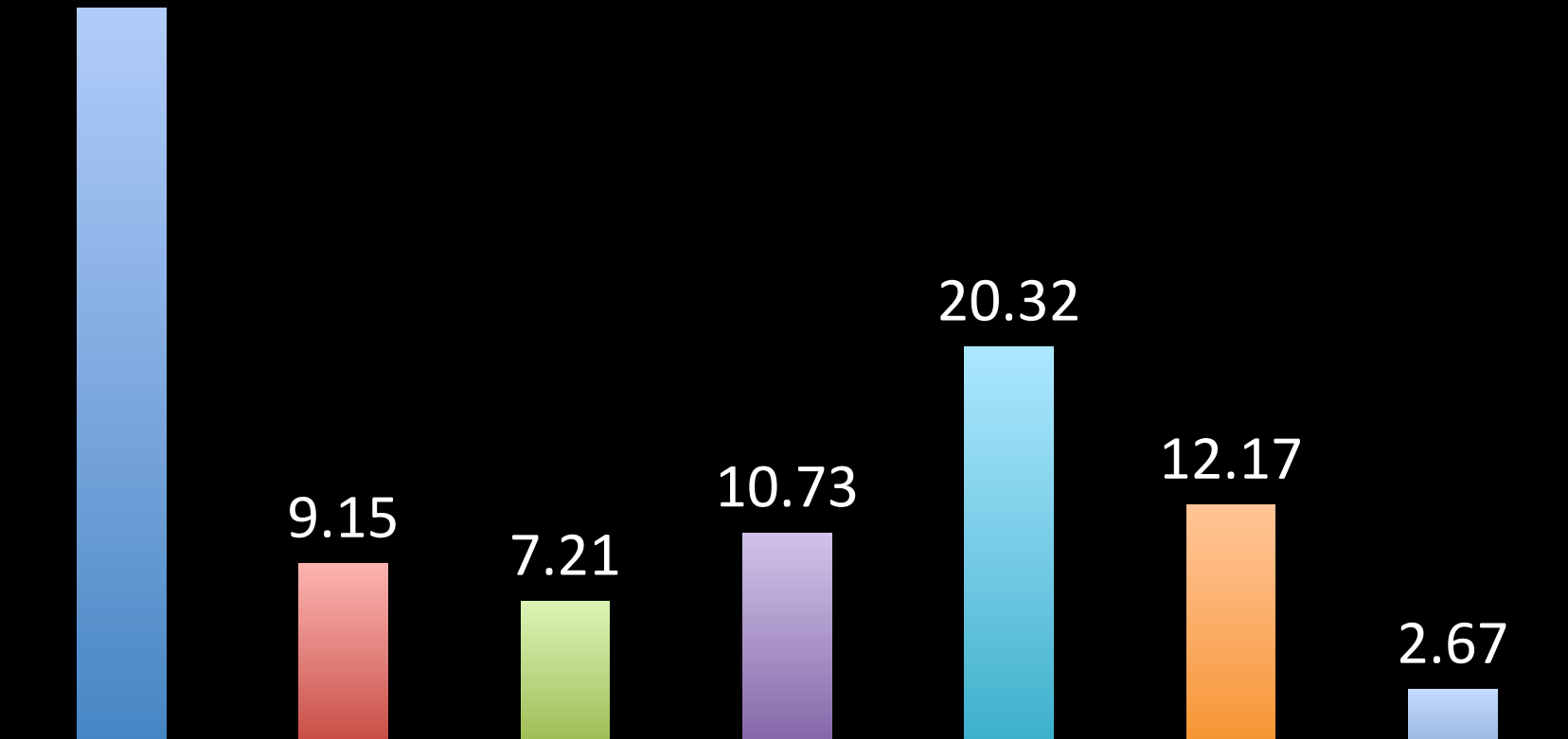
7.21

10.73

20.32

12.17

2.67



# First language reported in “profile”

First language reported	Percentage
English	66.97%
Spanish	15.78%
Portuguese	2.40%
Russian	1.31%
French	0.85%
German	0.58%
Languages and dialects of India	0.56%
Polish	0.53%
Chinese	0.50%
Greek	0.45%
Arabic	0.33%
Other	9.72%

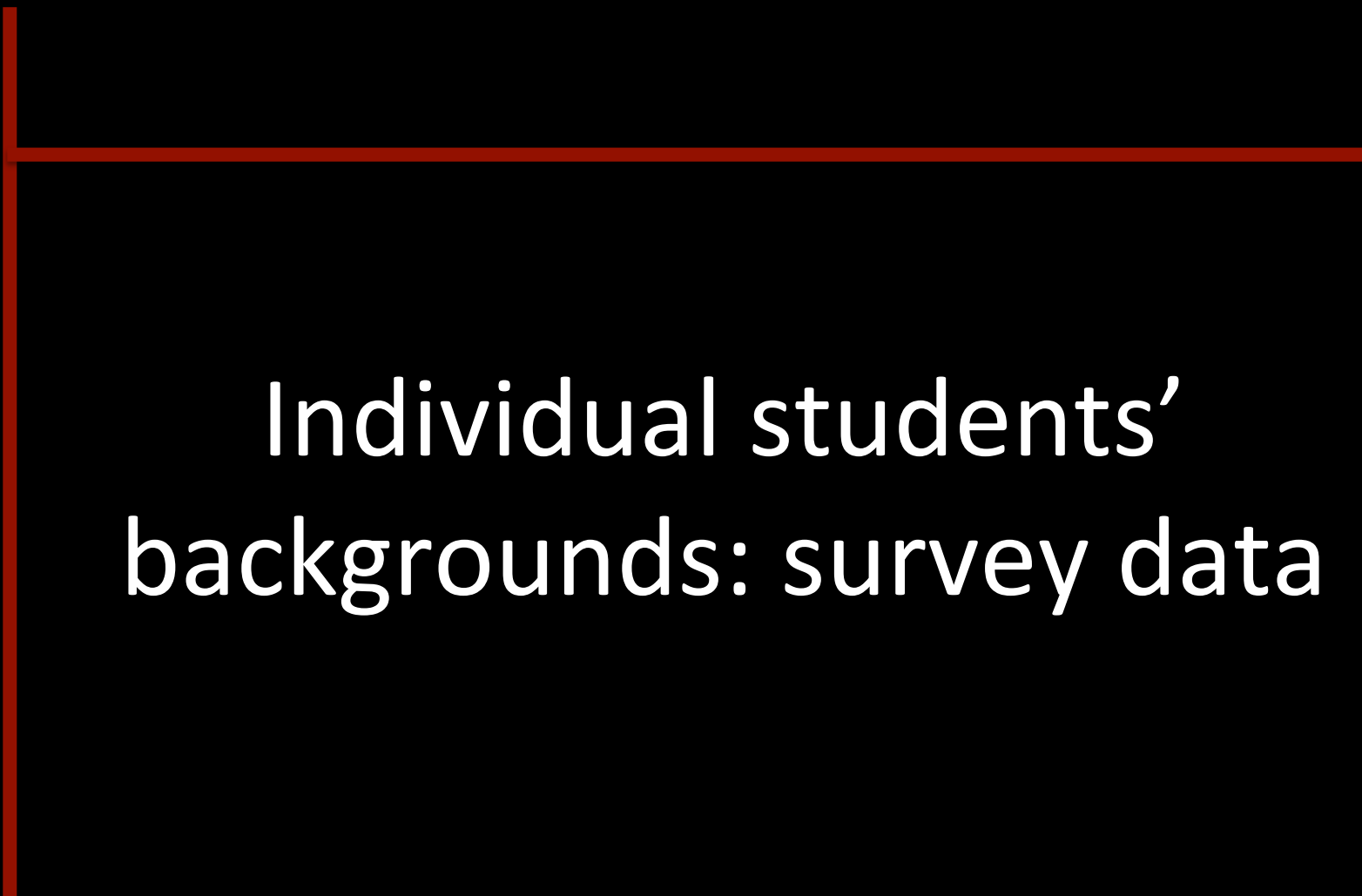
# Predominate language in country

**Non-English  
predominate  
country**

56.28%

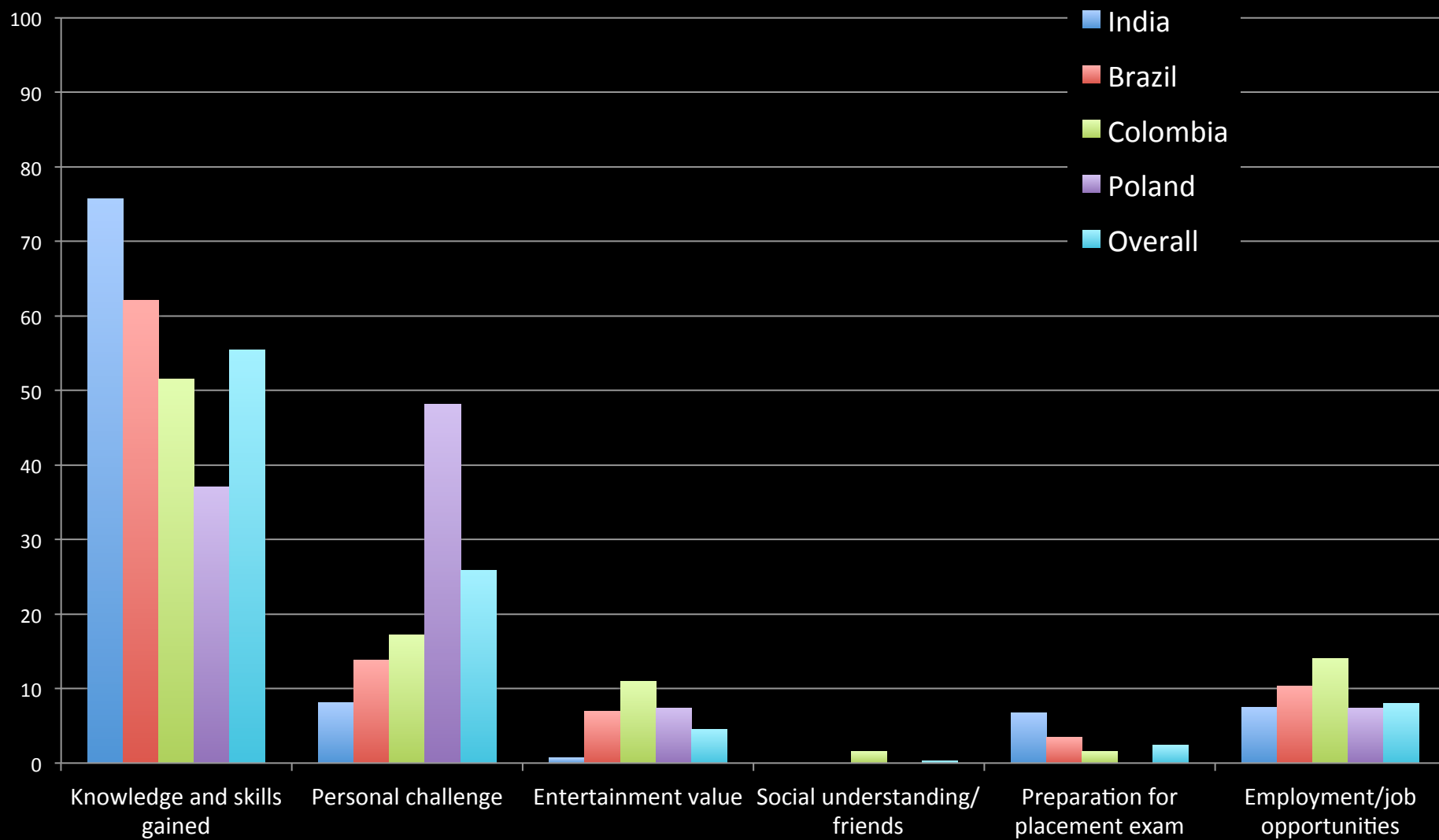
**Predominately  
English-speaking  
country**

43.72%

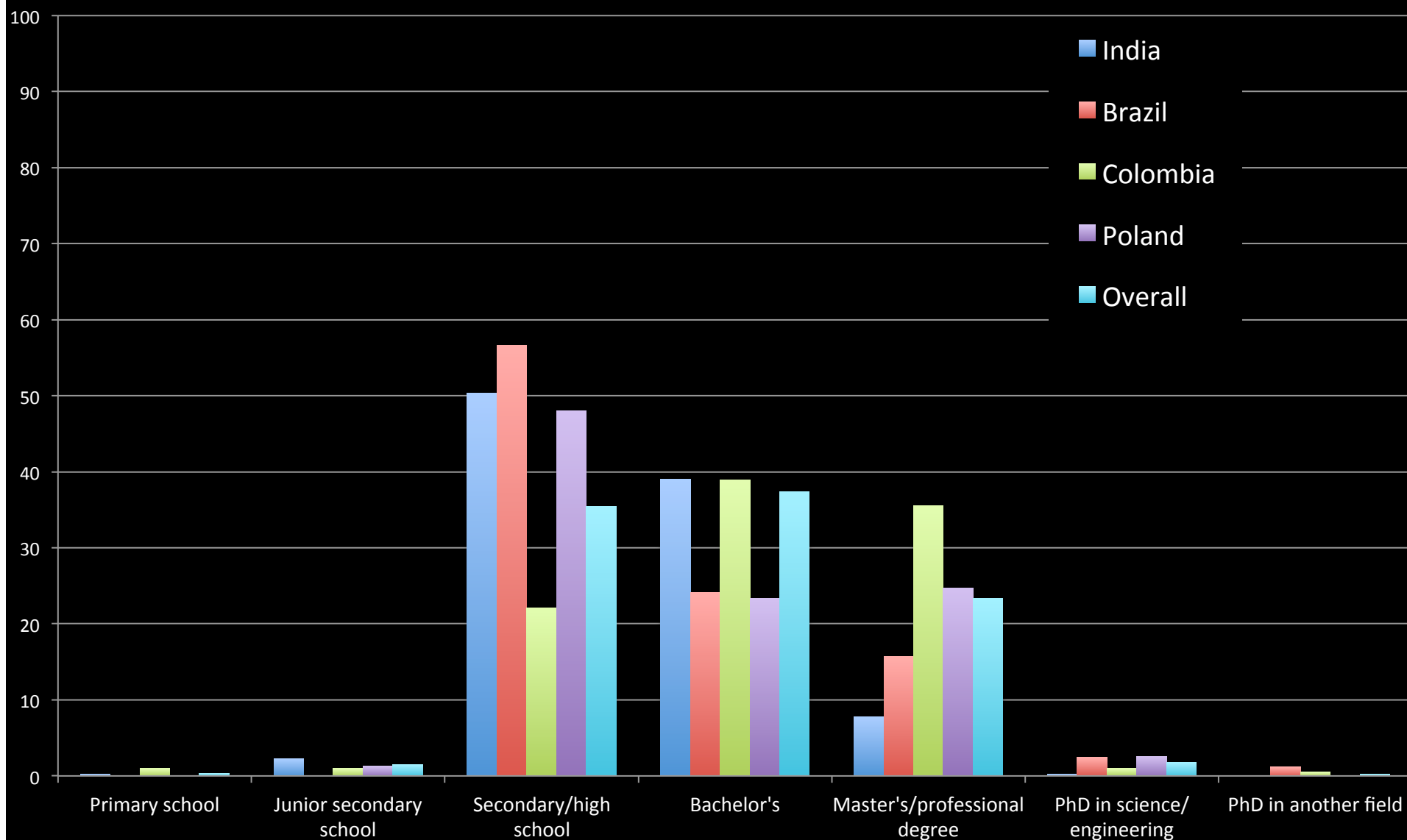
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Individual students'  
backgrounds: survey data

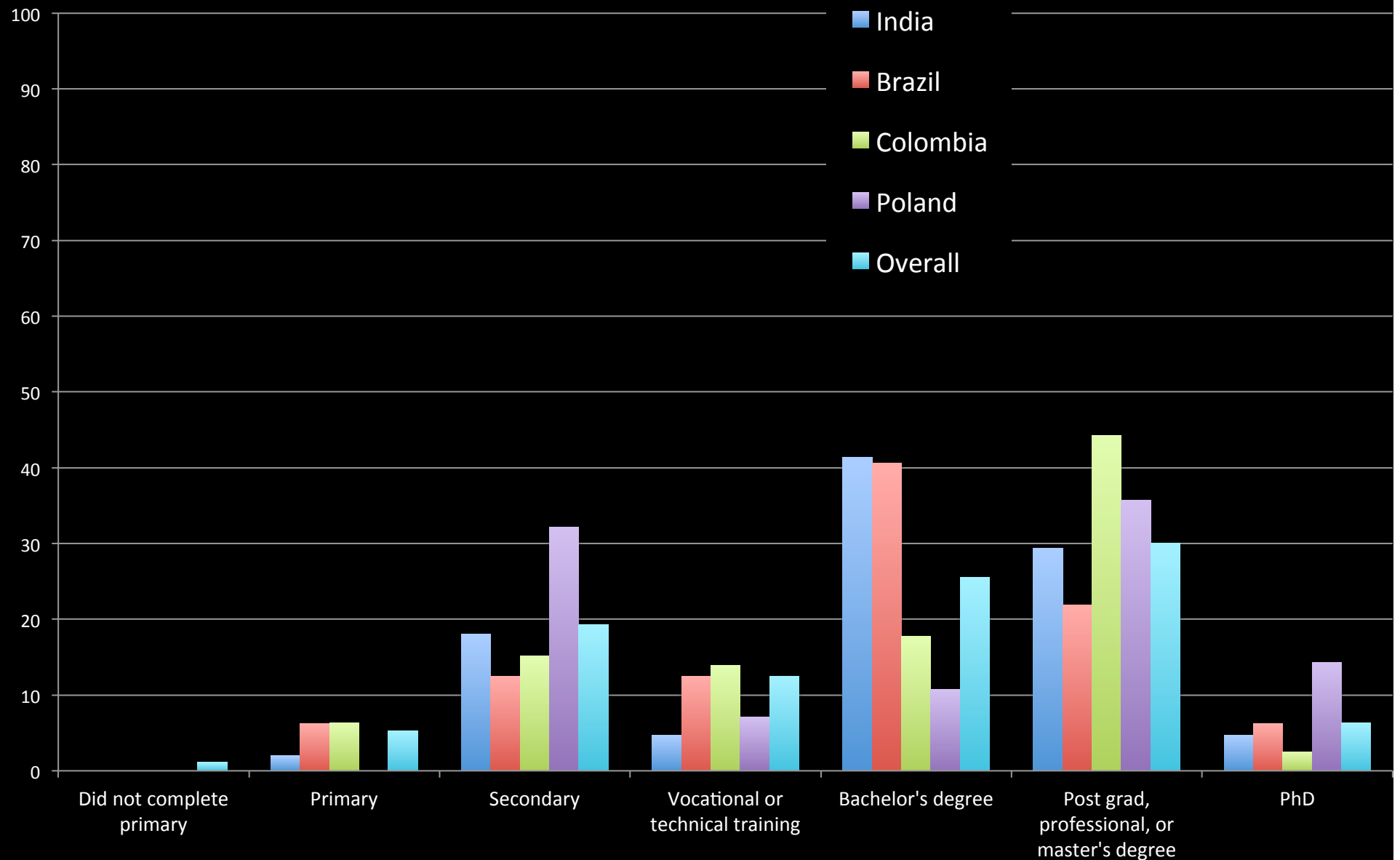
# Primary reason for enrollment



# Highest degree attained

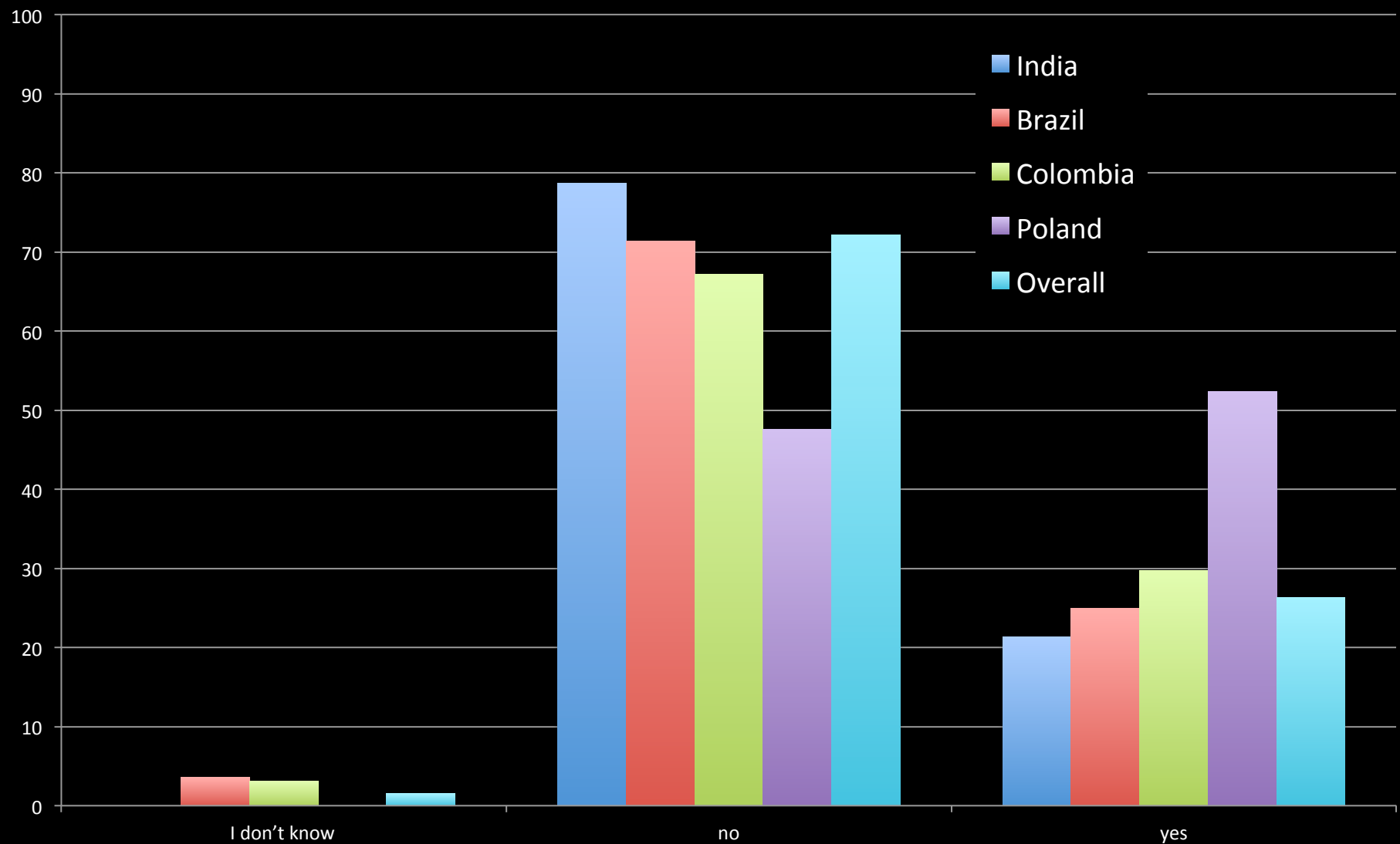


# Parents' highest degree





# Parents engineers



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Background, behaviors,  
and outcomes

## A closer descriptive look

- What different groups of students can we observe within national contexts?
- What resources are students in various contexts using?
- Are they successful?

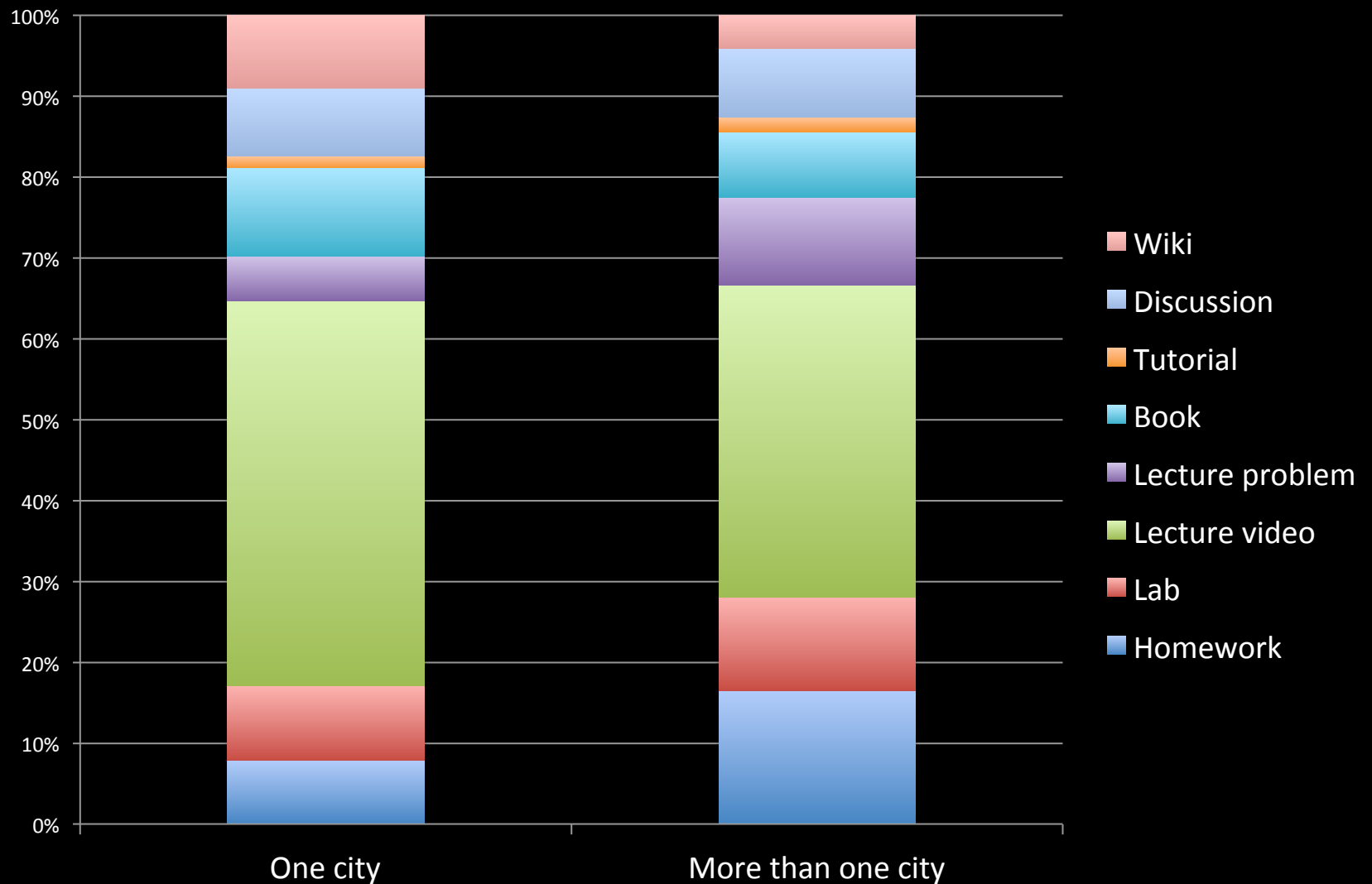
# First language reported and country context

	Non-English country	Predominately English-speaking country	Total
<b>English</b>	31,062	41,337	72,399
<b>Spanish</b>	15,595	347	15,942
<b>Portuguese</b>	2,542	24	2,566
<b>Russian</b>	1,574	51	1,625
<b>French</b>	794	131	925
<b>German</b>	657	21	678
<b>Polish</b>	601	20	621
<b>Greek</b>	545	9	554
<b>Chinese</b>	271	126	397
<b>Arabic</b>	314	27	341
<b>Languages and dialects of India</b>	295	253	548
<b>Other</b>	6,041	4,496	10,537
<b>Total</b>	60,291	46,842	107,133

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# Usage and demographics

# Travelers use different resources



# Behaviors and performance by language and language context

<i>Individual</i>	<i>Country</i>	
	<b>Predominately English</b>	<b>Predominately other language</b>
	<b>English</b>	<b>Other language</b>
<b>English</b>	1.) 24.15%	1.) 29.68%
<b>Other language</b>	1.) 23.80%	1.) 29.35%

1. Average grade (in percentage) for students who scored any points

# Behaviors and performance by language and language context

<i>Individual</i>	<i>Country</i>	
	<b>Predominately English</b>	<b>Predominately other language</b>
<b>English</b>	1.) 24.15% 2.) 93.02	1.) 29.68% 2.) 107.165
<b>Other language</b>	1.) 23.80% 2.) 72.42	1.) 29.35% 2.) 112.76

1. Average grade (in percentage) for students who scored any points
2. Homework problem attempts



# Behaviors and performance by language and language context

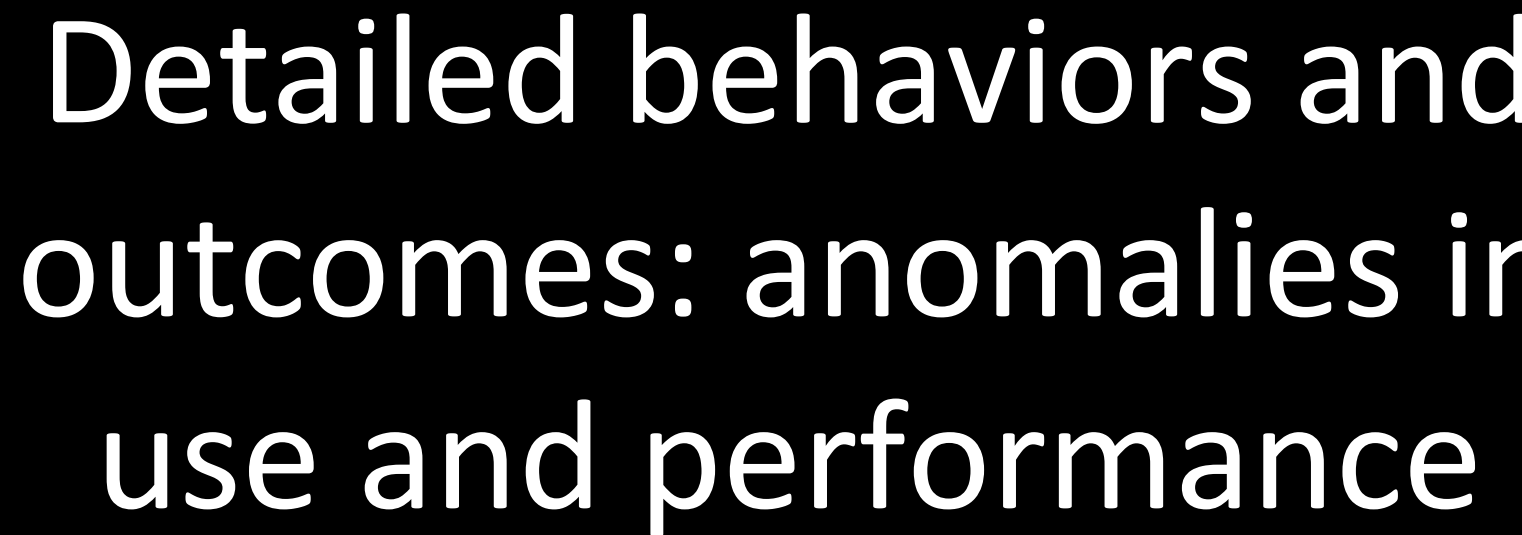
<i>Individual</i>	<i>Country</i>	
	<b>Predominately English</b>	<b>Predominately other language</b>
<b>English</b>	1.) 24.15% 2.) 93.02 3.) 0.59	1.) 29.68% 2.) 107.165 3.) 0.78
<b>Other language</b>	1.) 23.80% 2.) 72.42 3.) 0.54	1.) 29.35% 2.) 112.76 3.) 0.54

1. Average grade (in percentage) for students who scored any points
2. Ave. homework problem attempts
3. Ave. number of posts on the discussion forum

# Behaviors and performance by language and language context

<i>Individual</i>	<i>Country</i>	
	<b>Predominately English</b>	<b>Predominately other language</b>
<b>English</b>	1.) 24.15% 2.) 93.02 3.) 0.59 4.) 3.1	1.) 29.68% 2.) 107.165 3.) 0.78 4.) 3.2
<b>Other language</b>	1.) 23.80% 2.) 72.42 3.) 0.54 4.) 2.5	1.) 29.35% 2.) 112.76 3.) 0.54 4.) 3.2

1. Average grade (in percentage) for students who scored any points
2. Homework problem attempts
3. Number of posts on the discussion forum
4. Hours spent on lecture videos



Detailed behaviors and  
outcomes: anomalies in  
use and performance

# Urbanicity – generally weak relationship



# High performers, concentrated in urban centers

- Significant positive relationship between city size (urbanicity) and grade in class
  - India
  - Nigeria
  - South Africa
  - Chile
  - Egypt





## High level of posting in low and lower-middle income Spanish-speaking countries

- In Venezuela, average number of “answers” posted was over 1 (1.03)




### Habla hispana

3

español



Hola a todos desde Caracas, Venezuela. Me gustaría saber cuantos hermanos hay de habla española haciendo este maravilloso curso, pero que no esten en USA...saludos y suerte a todos....

Disponible en @  Twitter...saludos a todos

# Most proportional time allotment similar across countries

- Most countries averaged low proportions of time spent on the e-textbook; students in Nigeria spent nearly 17% of their time on the e-text

MITx - Circuits and Electronics

Courseware

Course Info

Textbook

Discussion

Wiki

Profile

## Table of Contents



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## ANALYSIS OF NONLINEAR CIRCUITS

Thus far we have discussed a variety of circuits containing linear devices such as resistors and voltage sources. We have also discussed methods of analyzing linear circuits built out of these elements. In this chapter, we extend our repertoire of network elements and corresponding analysis techniques by introducing a nonlinear two-terminal device called a *nonlinear resistor*. Recall, from Section 1.5.2, a nonlinear resistor is an element that has a nonlinear, algebraic relation between its instantaneous terminal current and its instantaneous

# 4

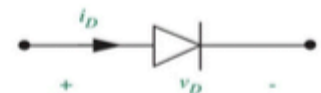


FIGURE 4.1 The symbol for a

## Students are nested within a country context

- Country factors:
  - Language
  - National income level/inequality
  - Internet penetration
- Individual factors
  - Language
  - Urbanicity
  - Use of site resources

*Multi-level model analyzing which individual and group factors mattered*



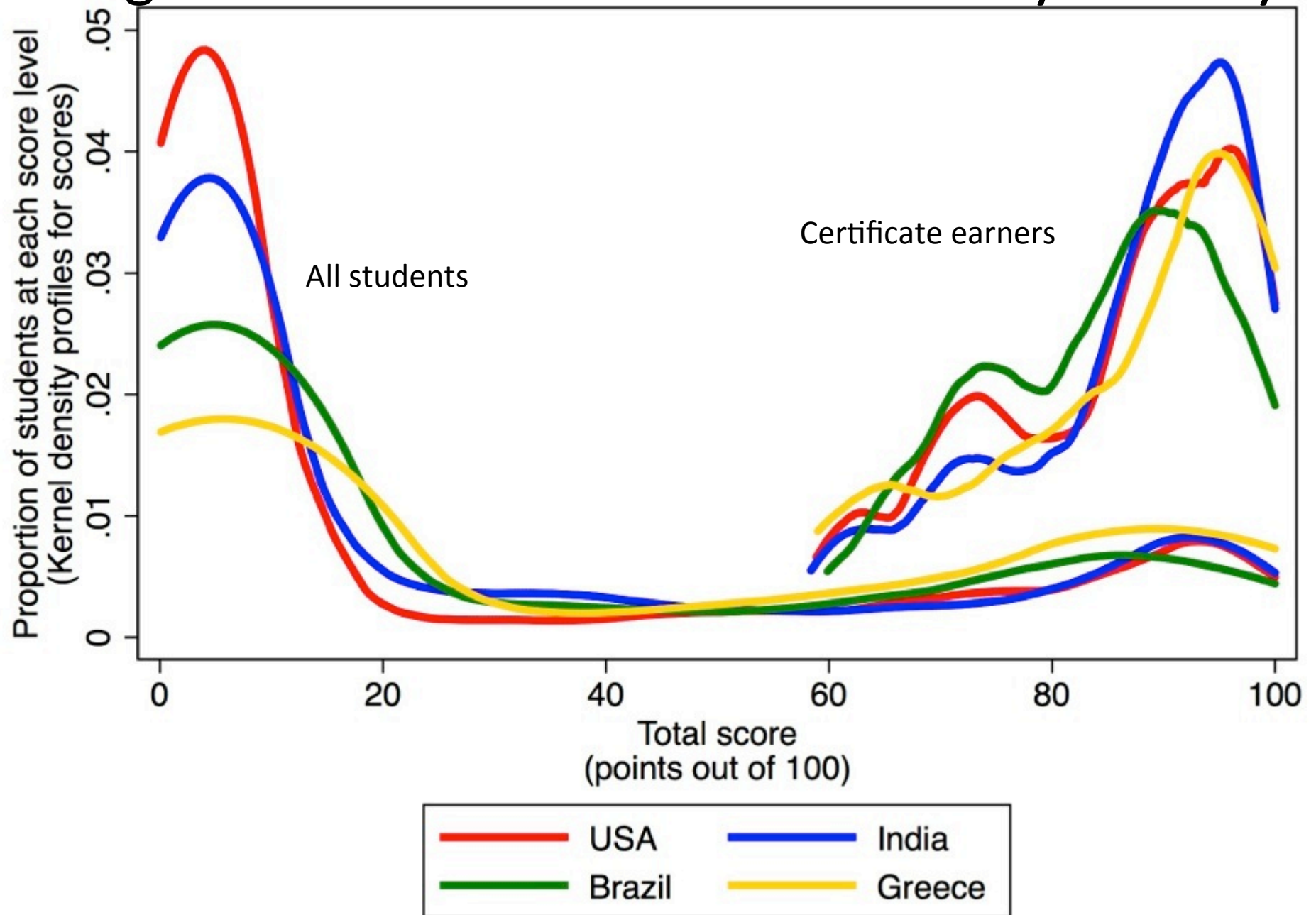


# Predictive modeling

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# Distributional differences

# Significant differences in variance by country



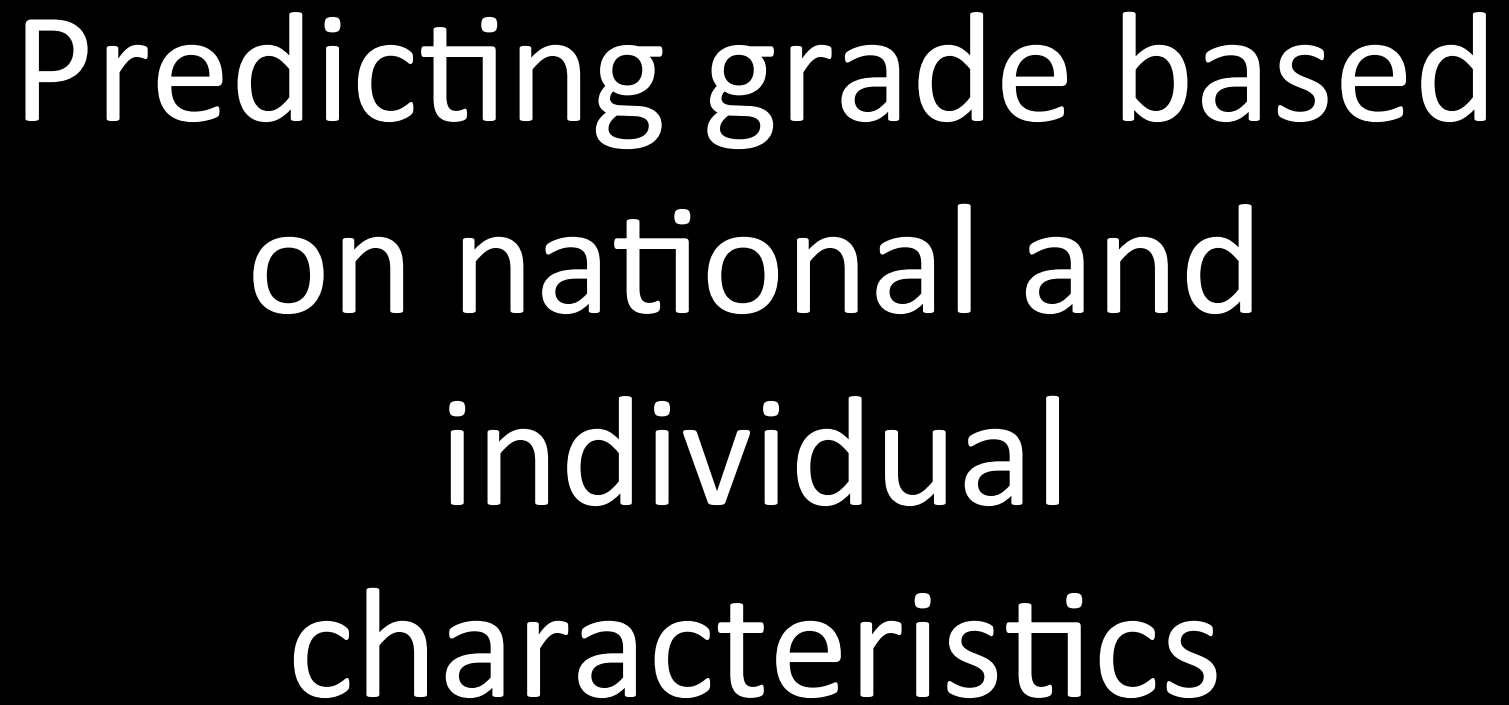
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# Variance in performance

Variance in performance

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Less than 10% shared  
within country groups

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Predicting grade based  
on national and  
individual  
characteristics

## Summary of predictive findings

- Both individual behaviors and national characteristics significantly predict achievement
  - Predominant language important, especially wrt individual language
  - Time spent on materials such as homework assignments important
- Some variance shared by students within countries, but most is between individuals

# Implications for development

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- Students in unique country contexts demonstrate unique behaviors.
- Still an access issue  
*Are educational technologies widening the gap?*
- Context-specific platforms, context-specific courses



# Implications for development

- Assessment, M&E



- Continuing education



# Questions or follow-up

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