



# Online Social Learning Innovation and Accountability

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*edX.org*

*@agarwaledu*









Innovation: What is Possible in  
Education with “Zero” Marginal Cost

Accountability: How to you measure,  
validate and improve



# edX.org is a Non-Profit Founded by Harvard and MIT

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## Learn from the best. Anytime. Anywhere.

Join our growing global community of over 5 million learners

Find Courses

MIT Massachusetts Institute of Technology HARVARD UNIVERSITY Berkeley UNIVERSITY OF CALIFORNIA THE UNIVERSITY of TEXAS SYSTEM TU Delft Australian National University

### Popular Courses Starting Soon

 MongoDBx M101x Introduction to MongoDB using the MEAN Stack Starting Soon Starts: November 16, 2015 - Self-Paced	 BUx ComplianceX Legal Risk Management Strategies for Multinational Enterprises Current Self-Paced	 UC3Mx IT.1.1x Introduction to Programming with Java Part 1: Starting to Code with Java Starting Soon Starts: November 17, 2015 - Self-Paced	 Microsoft DEV204x Programming with C# Current Self-Paced
 MITx 6.00.2x Introduction to Computational	 ColumbiaX DS101X Statistical Thinking for Data Science	 UQx IELTSx IELTS Academic Test Preparation	 CurtinX MKT1x Digital Branding and Engagement

Expand access to *quality* education

Improve on-campus education

Advance research





# The edX Impact



**6MM** Learners



**196+**  
All Countries



**20MM**  
Course Enrollments



**750** Courses  
English, French,  
Mandarin, Hindi

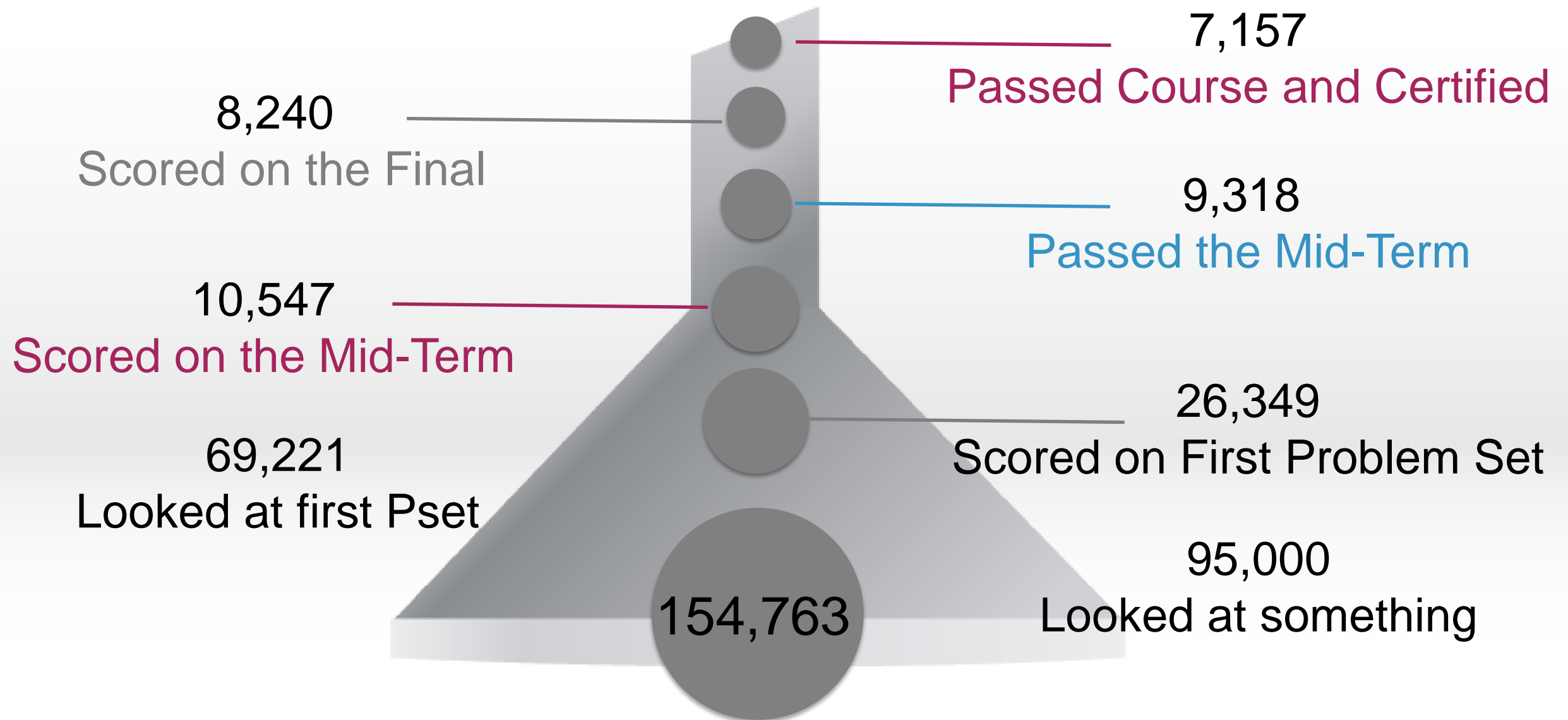


**~100**  
Institutions



**200+**  
Blended Classes  
15,000+ Enrollments

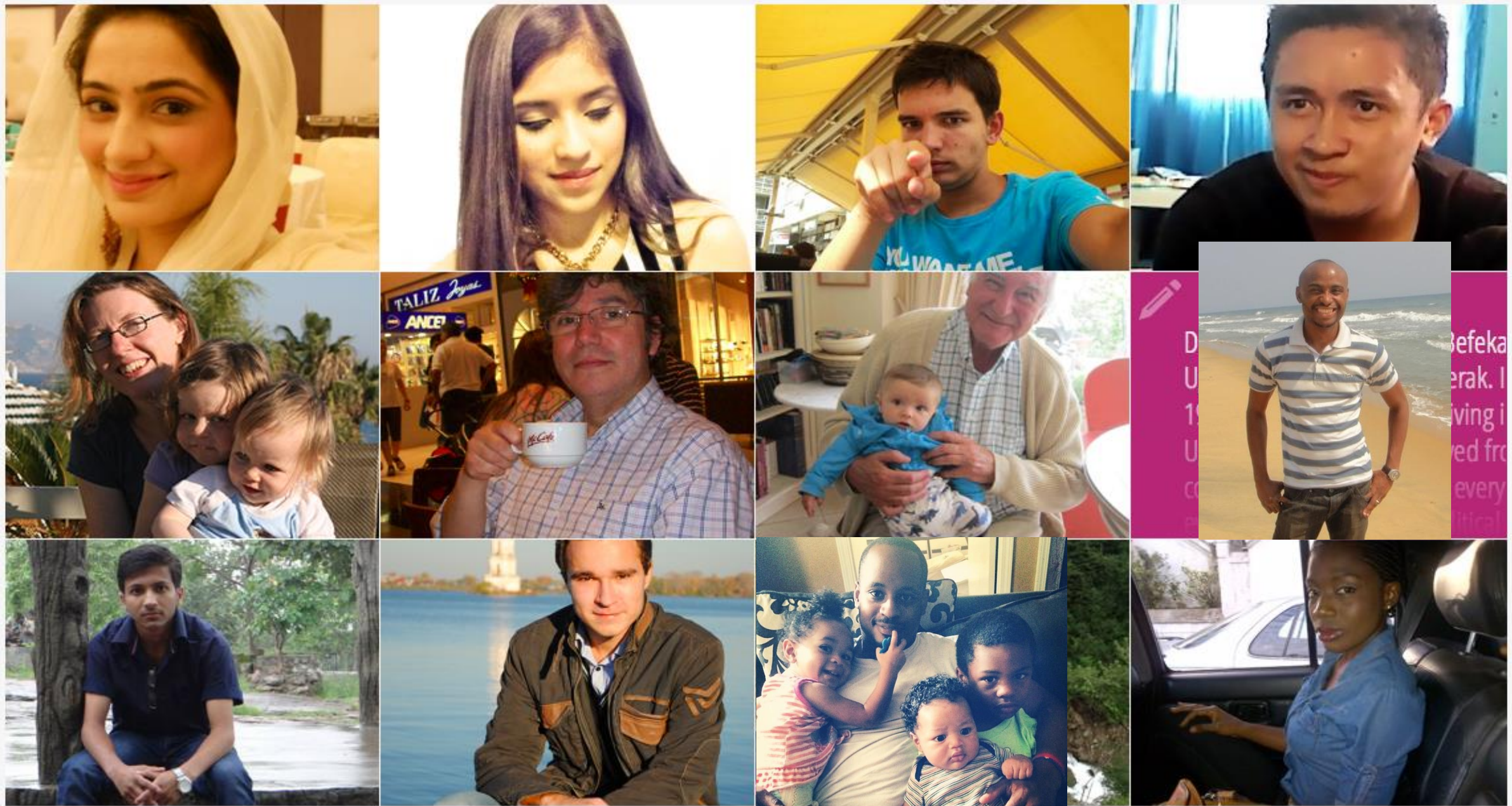
# 155,000 Students Enrolled in First Course



The impact of “zero” marginal cost



# Who are edX learners?



Shawn Jones  
Job with Yellowbrick



Powered by OPENedX



Website: xuetang.com 学堂在线

Navigation: 关于我们 | 现在注册

Header: 来自学堂在线的MOOC课程

Search: 你想学习什么? 搜索

Grid of course thumbnails:

- 清华大学 (Tsinghua X)
- 电路与电子学 (Circuits and Electronics)
- 计算机辅助翻译理论与实践 (Computer-Aided Translation Theory and Practice)
- MOOCs 课程与设置
- 清华大学人文学院与文科中心 (上)
- 清华大学电机学院 (一)



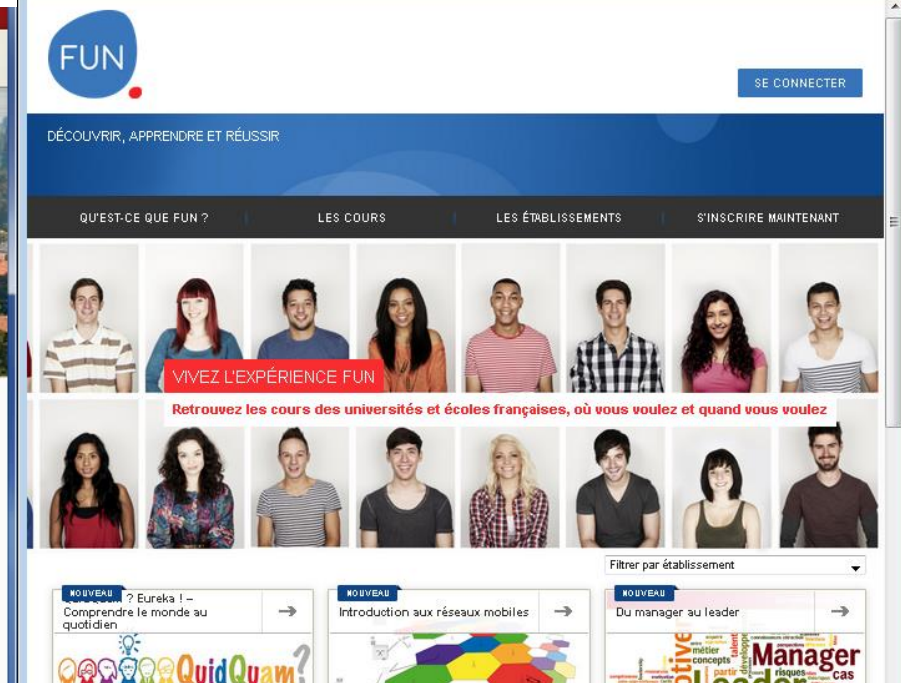
Website: Lagunita.Stanford.edu

Navigation: ABOUT | REGISTER NOW | Log In

Header: Free courses from Stanford for anyone, anywhere, anytime

Grid of course thumbnails:

- StatLearning: Statistical Learning
- Environmental Physiology: Your Body in the World
- Introduction to Databases
- Haptics: Introduction to Haptics
- QMSEB: Quantum Mechanics for Scientists and Engineers
- SciWrite: Writing in the Sciences



Website: FUN

Navigation: DÉCOUVRIR, APPRENDRE ET RÉUSSIR

Menu: QU'EST-CE QUE FUN? | LES COURS | LES ÉTABLISSEMENTS | S'INSCRIRE MAINTENANT

Header: VIVEZ L'EXPÉRIENCE FUN

Text: Retrouvez les cours des universités et écoles françaises, où vous voulez et quand vous voulez

Grid of course thumbnails:

- Eureka 1 - Comprendre le monde au quotidien
- Introduction aux réseaux mobiles
- Du manager au leader



Website: edraak.org

Navigation: Most Visited | bofa | tda | MarketWatch | Getting Started | Latest Headlines

Header: إدراك EDRAAK

Text: إدراك هي منصة الكترونية عربية للمساقات. تعرف باللغة الإنجليزية باسم (موكس)، وهذه المنصة تكي بمبادرة من تنمية.

Text: على بذل كافة الجهود والمساعي لوضع العالم العربي في المقدمة في مجال ساس لتطور و ازدهار الشعوب.

Text: سخر الموارد البشرية العربية الموجودة في المنطقة لانشاء " إدراك" كأول كس" بالشراكة مع "اد اكس"، وهي مؤسسة مشتركة بين جامعتي هارفرد يا، ومختصة في هذا المجال.

Text: فريدة ومهمة للوطن العربي، وستفتح المجال للمتعلمين العرب للالتحاق عبر رة من قبل أفضل الجامعات العالمية مثل هارفرد، مكجيل، ويوسى بركلي مع ، اتقان في بعض منها، وستفتح المجال ايضا للالتحاق بمساقات جديدة باللغة رب لاتراء التعليم عربيًا. و من الجدير بالذكر أن كافة المساقات على منصة

Navigation: Course | FAQ | Resources

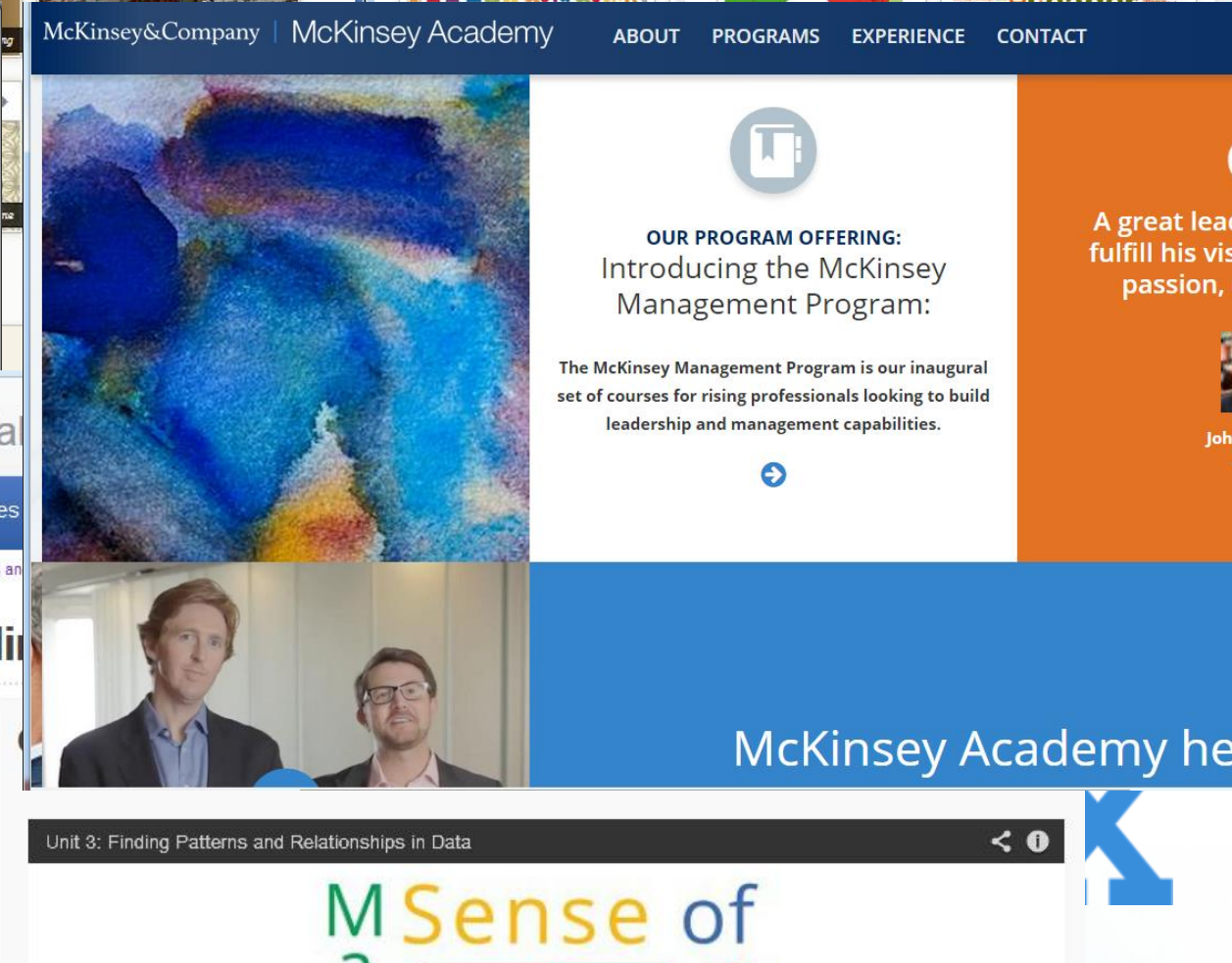
Unit 3 - Finding Patterns and Relationships in Data

1. Overview

2. Activity: Forest Area, Part 1

3. Finding Relationships by Merging Data

4. Activity: Forest Area, Part 2



Website: McKinsey Academy

Navigation: ABOUT | PROGRAMS | EXPERIENCE | CONTACT

Header: OUR PROGRAM OFFERING: Introducing the McKinsey Management Program:

Text: The McKinsey Management Program is our inaugural set of courses for rising professionals looking to build leadership and management capabilities.

Text: A great leader fulfill his vision passion, no

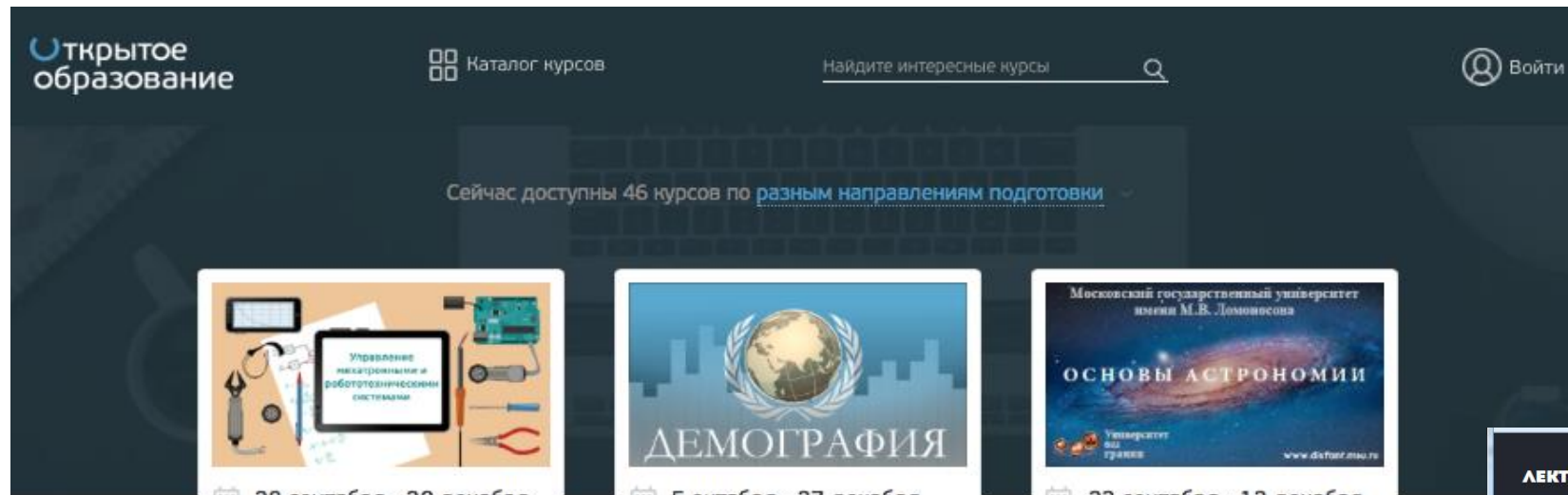
Text: McKinsey Academy help

Text: Unit 3: Finding Patterns and Relationships in Data

Text: M Sense of a



# Russian National Online Platform **Openedu.ru** Launched Sep 14, 2015 Powered by



28 сентября - 20 декабря  
Старт через 14 дней

Управление мехатронными и робототехническими системами

Университет ИТМО

5 октября - 27 декабря  
Старт через 21 день

Демография

НИУ ВШЭ

23 сентября - 13 декабря  
Старт через 9 дней

Основы астрономии

МГУ

23 сентября - 12 декабря  
Старт через 9 дней

Сопромат

ННТУ «МИСиС»

21 сентября - 27 января  
Старт через 7 дней

Теоретическая механика

МФТИ

16 ноября - 21 февраля  
Старт через 63 дня

История России IX–XXI вв.

СПбГУ

ЛЕКТОРИУМ

Старшеклассникам и абитуриентам | Студентам и специалистам | Повышение квалификации | Архив видеолекций | Очные программы

50 000 студентов, 4000 часов видео, 20+ партнёров

15 октября - 30 декабря  
Старт через 31 день

$b=0$   $b=1$

23 сентября - 26 января  
Старт через 9 дней

Сейчас доступны

46 курсов

Полный каталог курсов

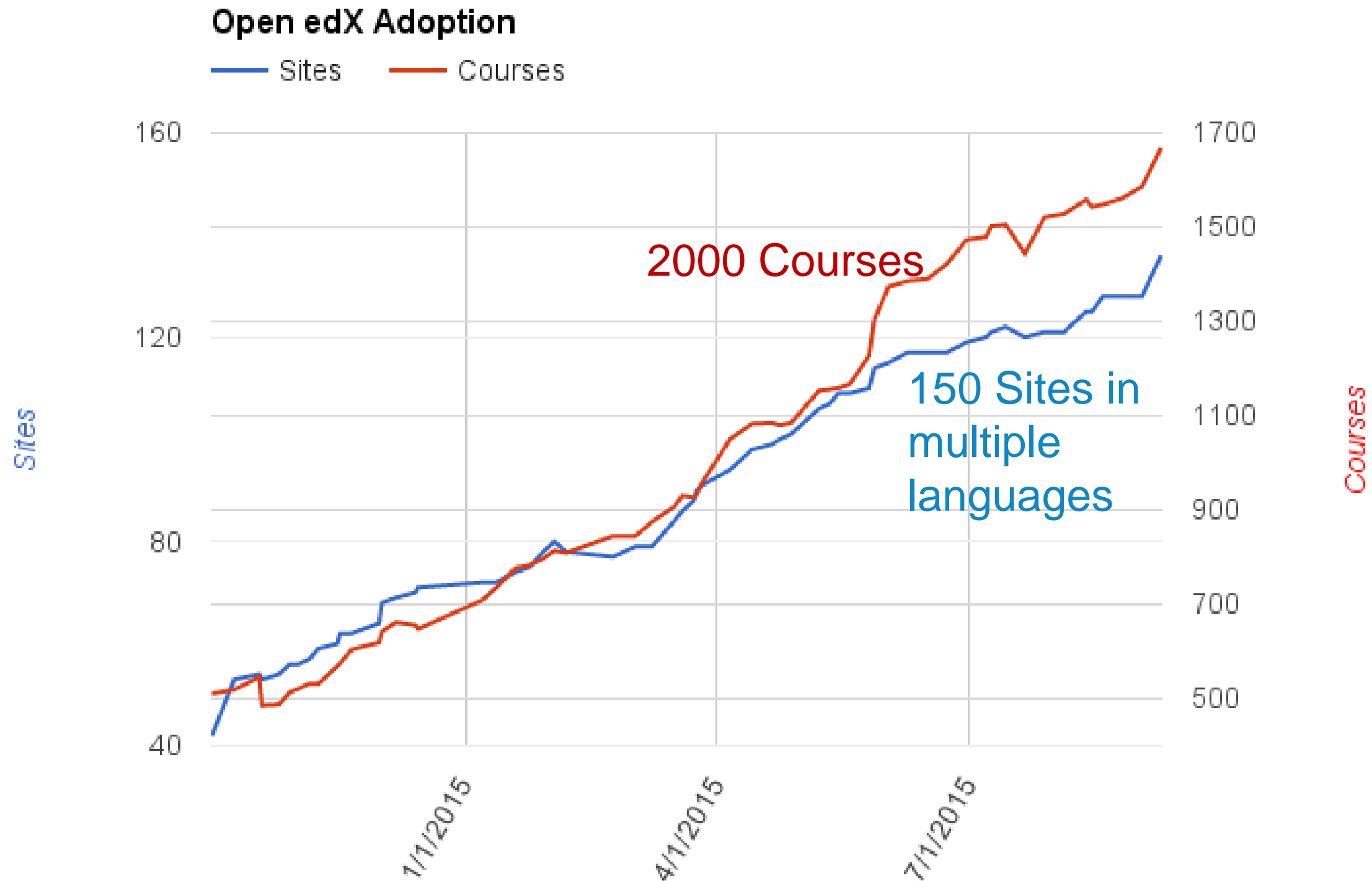
46 Courses

“...this summer Lektorium opened a course, intended to develop Russian community of OpenedX users” – [www.lektorium.tv](http://www.lektorium.tv)





# Open edX is Now Worldwide Movement



\*Likely order of magnitude more courses on sites we do not know about





# Anatomy of an edX Online Class – Active Learning



WellesleyX: HIST229x Was Alexander Great?



Courseware Course Info Discussion Wiki Progress Open Ended Panel Syllabus Instructor **Staff view**

- ▶ Week 1
- ▶ Week 2
- ▶ Week 3
- ▶ Week 4
- ▶ Week 5
- ▶ Week 6
- ▶ Week 7
- ▶ Week 8 Fun Activity
- ▶ Week 8 Mid-Term
- ▼ Week 9

**Class 15: The Massacre of the Branchidae and the Wrath of Dionysos**  
Exam

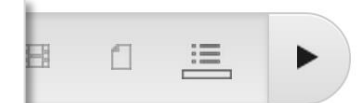
**Class 16: The End of the Revolts and One Kiss the Poorer**



Learning and retention is related to the depth of mental processing.  
- Craik and Lockhart 1972



3:48 / 6:00 SPEED 1.0x [Volume] [Full Screen] HD CC



VIEW UNIT IN STUDIO

spring of 329.  
the Macedonians  
Kush,  
the "death of Hindus"  
spring of 329.  
through the Caucasus or  
stances with a large  
believable logistical  
significant loss of life  
precedented.  
, was terrified at the  
mination  
of the Hindu Kush  
on the part of Alexander and the  
Macedonians.  
Despite the conditions and Bessus'





# Instant Feedback

Overview

Week 1

Why Solid-State Chemistry?

Learning Sequence

Modern Chemical Concepts  
and Periodicity of the  
Elements

Learning Sequence

The Electron and Light

Learning Sequence

Additional Study Material

Problem Set 1

Homework due October 28



Week 2

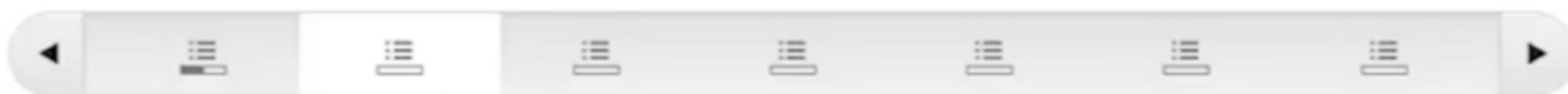
Week 3

Week 4

Exam 1

Week 5

Week 6



## H1P2: DECOMPOSITION OF AMMONIUM NITRATE

Solid  $\text{NH}_4\text{NO}_3$  (ammonium nitrate) decomposes on heating to  $400^\circ\text{C}$ , forming  $\text{N}_2\text{O}$  gas and water vapor,  $\text{H}_2\text{O}$ .

(a) Write a balanced chemical equation.

(b) Calculate the number of grams of  $\text{H}_2\text{O}$  that will form on decomposition of 0.10 mole of ammonium nitrate.

Check



Show Discussion

New Post





Overview

Week 1

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Modern Chemical Concepts  
and Periodicity of the  
Elements

Learning Sequence

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Learning Sequence

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Problem Set 1

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Week 2

Week 3

Week 4

Exam 1

Week 5

Week 6



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Check

Show Discussion

New Post





# Instant Feedback Improves Learning

*Rapid feedback has a significant and positive effect on student performance when compared to no rapid feedback.*

- Chen, Whittinghill, Kadlowec 2010



# Rich Problem Types

## String

In what state is Las Vegas located?

nv



## Formula

Resistance when  $R_1 \parallel R_2 =$

$(R_1 \cdot R_2) / (R_1 + R_2)$



$$\frac{R_1 \cdot R_2}{R_1 + R_2}$$

## Drag and drop

$$\lambda = \frac{\boxed{\phantom{-b}} \pm \sqrt{\boxed{b^2} \boxed{-4ac}}}{\boxed{+2a}}$$

◀	-b	+b	$b^{2\alpha}$	$b_{2\alpha}$	+4ac	-2a	▶
---	----	----	---------------	---------------	------	-----	---

## Open Response

Write an essay...

## Image

Where's Waldo?



Student selects point on image





# Virtual Labs and Gamification

strings.

I was trying to draw my favorite molecule, caffeine. Unfortunately, I'm not a very good biochemist. Can you correct my molecule?

New Lasso Single Benzene Hexane Pentane Carbon Center Ink

Unit Identifier:  
1f0144c8b1c34d069074d8511aaa2f93

New Section Name

New Subsection

New Unit - PRIVATE

+ New Unit

Check



# Virtual Labs and Gamification

The screenshot shows a web-based virtual lab interface. At the top left, there is a browser window title "ert" and a "Select" button. Below this, the text "strings." is visible. The main content area contains a text prompt: "I was trying to draw my favorite molecule, caffeine. Unfortunately, I'm not a very good biochemist. Can you correct my molecule?". Below the text is a drawing toolbar with nine icons: "New" (folder), "Lasso" (lasso), "Single" (orange circle with pencil), "Benzene" (benzene ring), "Hexane" (hexagon), "Pentane" (pentagon), "Carbon" (circle with 'C'), "Center" (starburst), and "Ink" (green pen). Below the toolbar is a large empty drawing area. At the bottom left of the drawing area, there is a red "X" icon and a "Check" button. On the right side of the interface, there is a sidebar with a "Unit Identifier:" field containing the value "1f0144c8b1c34d069074d8511aaa2f93". Below this are fields for "New Section Name" and "New Subsection". A yellow button labeled "New Unit - PRIVATE" is visible, along with a "+ New Unit" link.

# Credentialing and Xseries Programs

Course

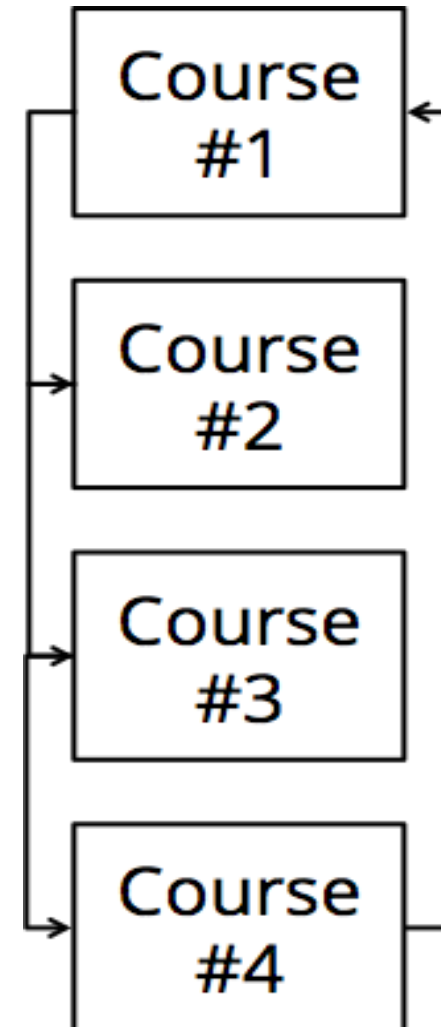
6%

Course

Verified  
Certificates of  
Achievement



60% pass



And now,  
college  
credit



Even  
higher





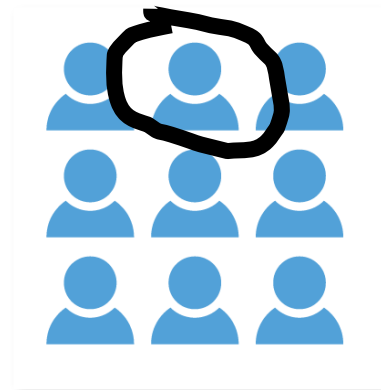
This is MOOC2.0



# MOOCs Double Down on Quality



Hand  
Grading



Adaptive  
Learning,  
Deep Per  
Student  
Analytics



Timed  
Exams



Virtual  
Proctored  
Exams,  
Randomized  
Problems



# MOOCs Get Personal and Social

Eagles project team

MOOC1.0

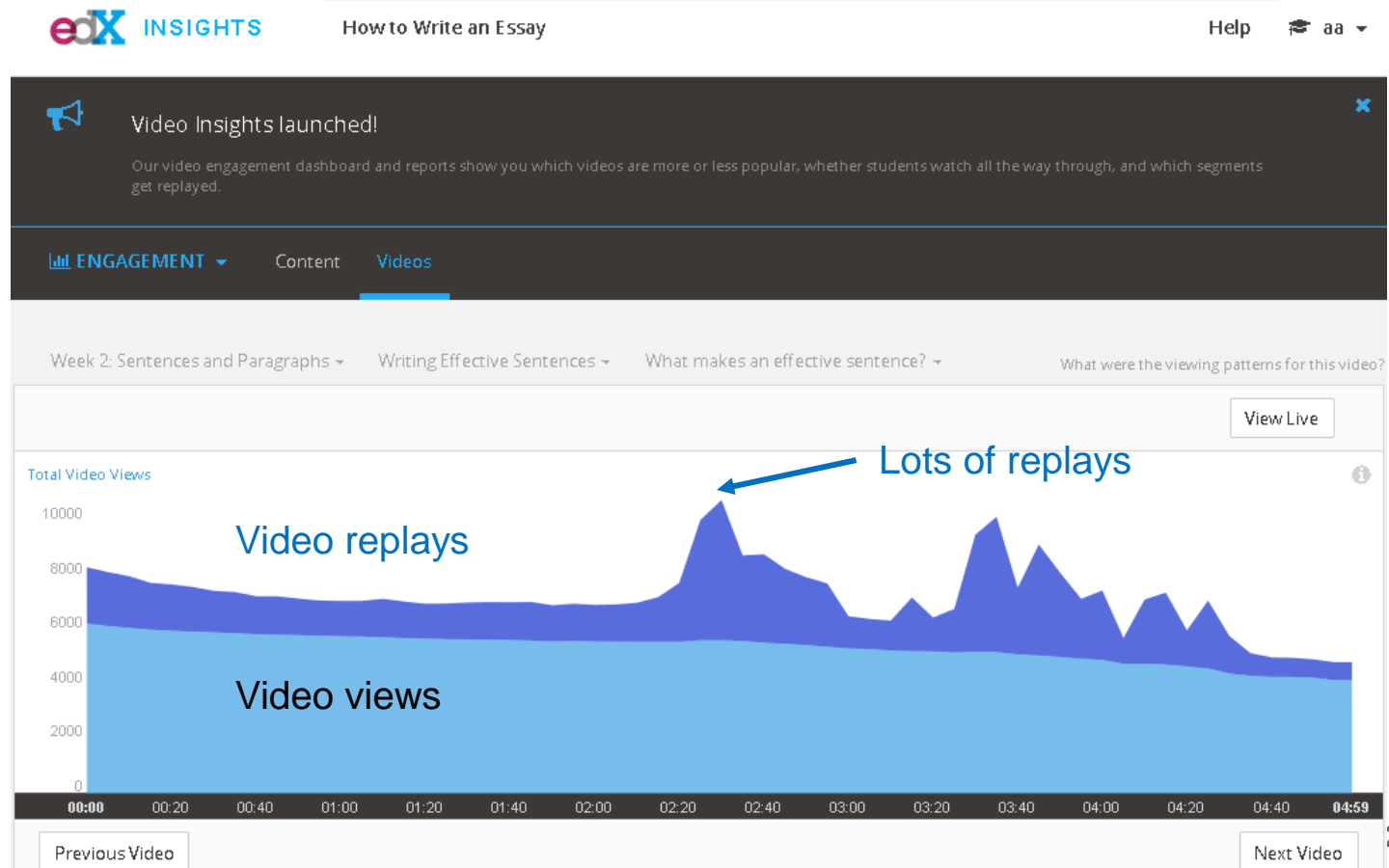
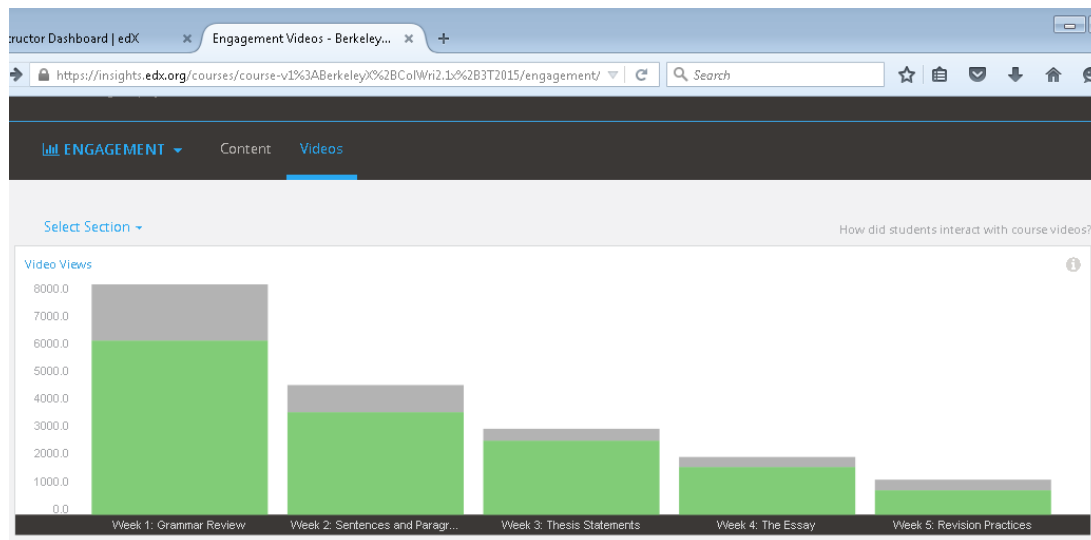
MOOC2.0

Credit cohort

Campus class



# A Particle Accelerator for Learning



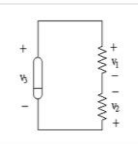


# A/B Testing Allows Education Engineering

## Group A: Text Lesson

STES: KVL-0 (1 point possible)

Joe was debugging part of an experimental apparatus, probing around with his voltmeter. Part of the apparatus had two obvious resistors in series with an unknown element, as shown in the diagram below:



The unknown element is hard to reach, so Joe put the negative (black) probe of his voltmeter at the interconnection of the two obvious resistors and then put the positive (red) probe at the other end of each resistor, measuring  $v_1 = 1.4V$  and  $v_2 = 0.9V$ .

## Common Intro

INTRODUCTION TO PLOTTING IN PYLAB

Some Useful Web Pages

- [http://matplotlib.org/api/pyplot\\_summary.html](http://matplotlib.org/api/pyplot_summary.html)
- [http://www.scipy.org/Plotting\\_Tutorial](http://www.scipy.org/Plotting_Tutorial)
- <http://matplotlib.sourceforge.net/users/customizing.html>



0:00 / 6:50

50%

## Group B: Video Lesson

Group A

DEFAULT KEYWORDS

Watch the Course Intro Video



0:03 / 8:26

50%

## Common Assessment

L1 PROBLEM 4 (4/4 points)

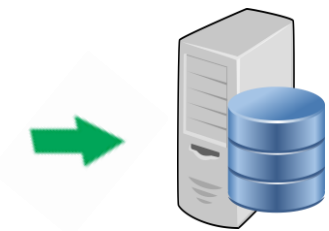
Note: This problem is contingent upon completing the exercises from L1 Problem 3.

Now for the plotting function! In pylab, the `plot` function takes in two equal sized lists and uses the first list as a list of the x-coordinates and the second list as a list of the y-coordinates.

In this problem we'll build a function `producePlot(lowTemps, highTemps)` which takes as parameters `lowTemps` (the list of low temperatures from your previous function) and `highTemps` (the list of high temperatures from your previous function).

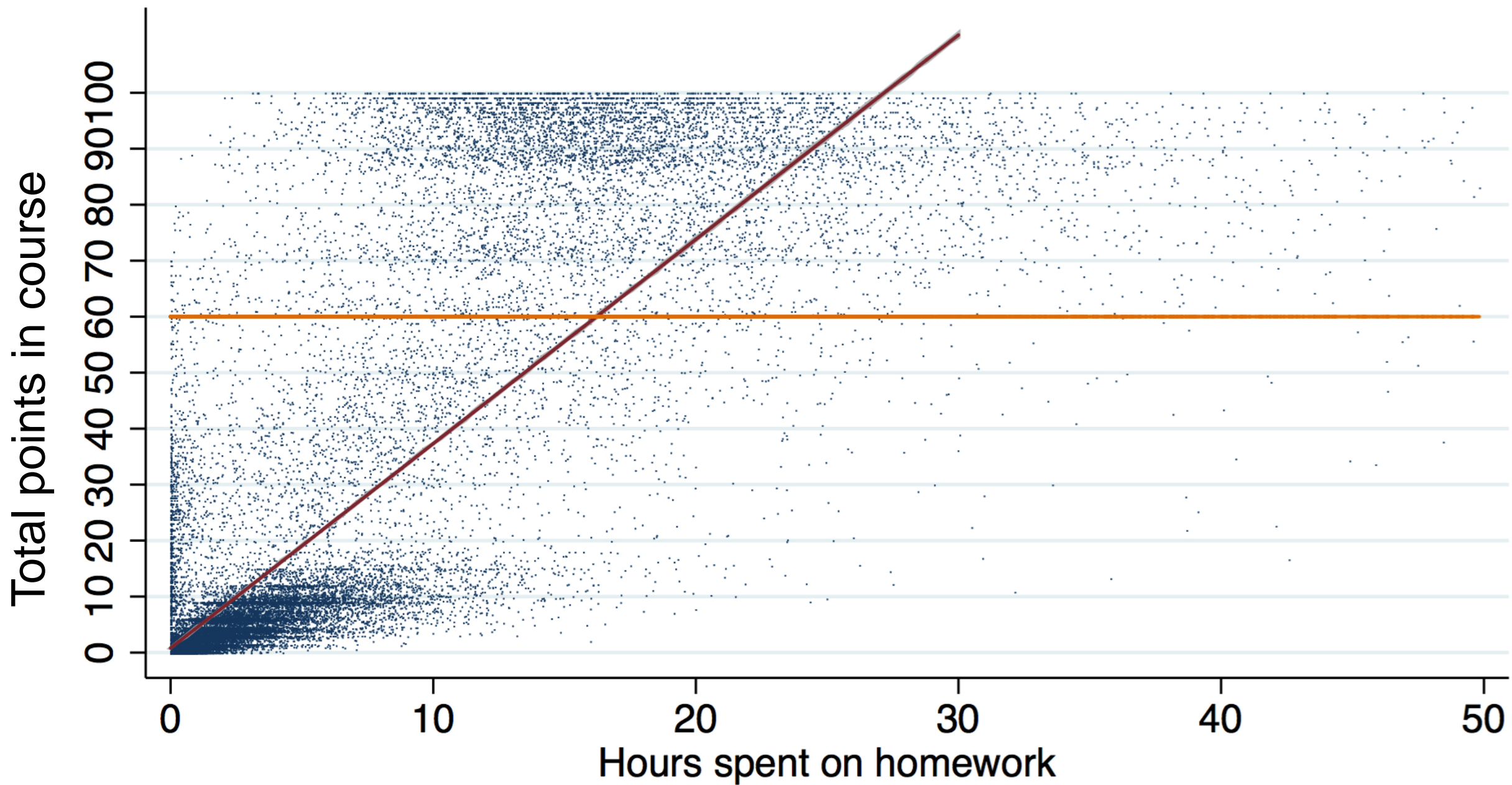
1. Define `diffTemps` as a list which is the element by element difference between `highTemps` and `lowTemps`. Which is a valid plotting statement for a graph with days on the horizontal axis and the temperature difference on the vertical axis?

- `pylab.plot(highTemps, lowTemps)`
- `pylab.plot(range(1,32), highTemps)`
- `pylab.plot(range(1,32), lowTemps)`
- `pylab.plot(range(1,32), diffTemps)` ✓
- `pylab.plot(diffTemps, range(1,32))`



Student event logs show relative performance and engagement of each group.

# Hours Spent on Homework in Relation to Total Points in Course



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



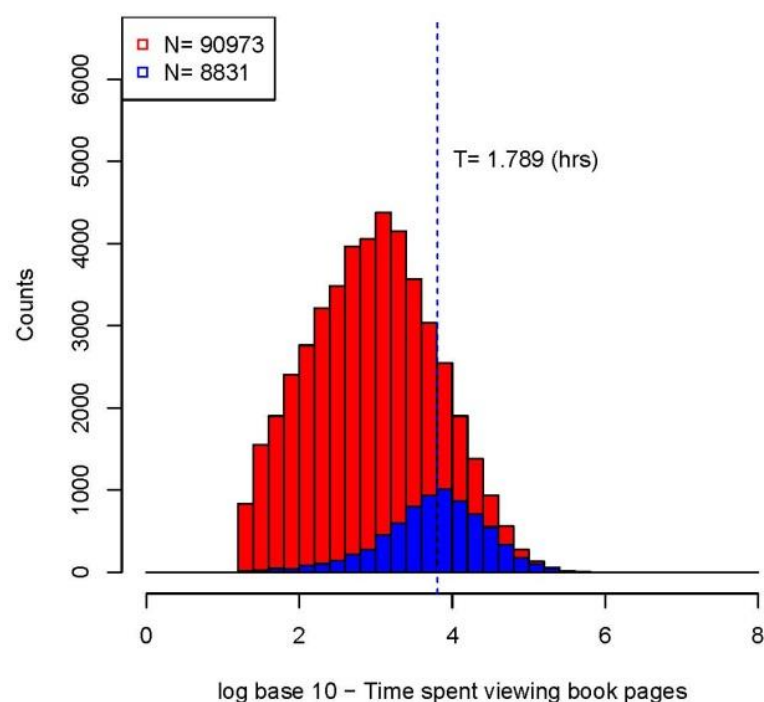
# Access to Research in Learning on an Unprecedented Scale

## Online textbook

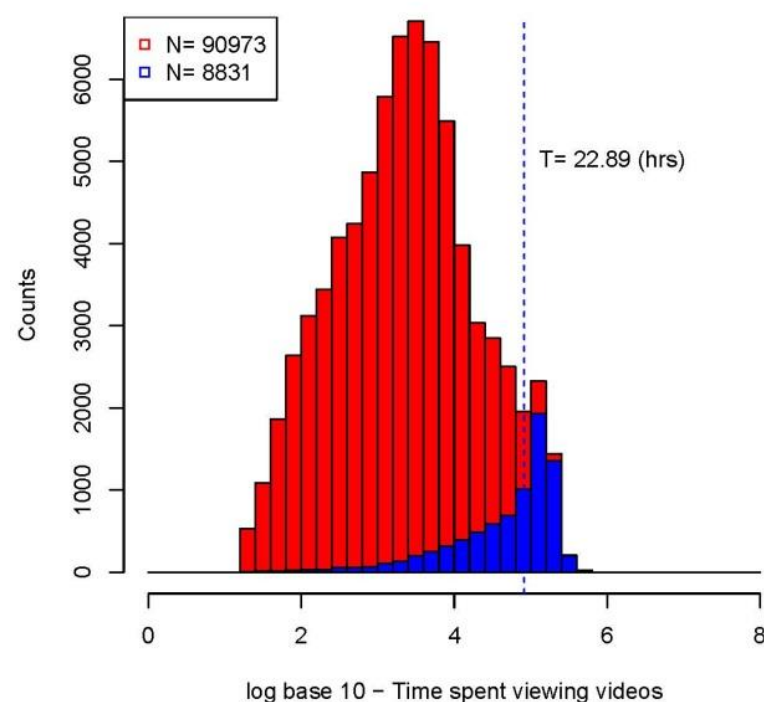
## Videos

## Assessments

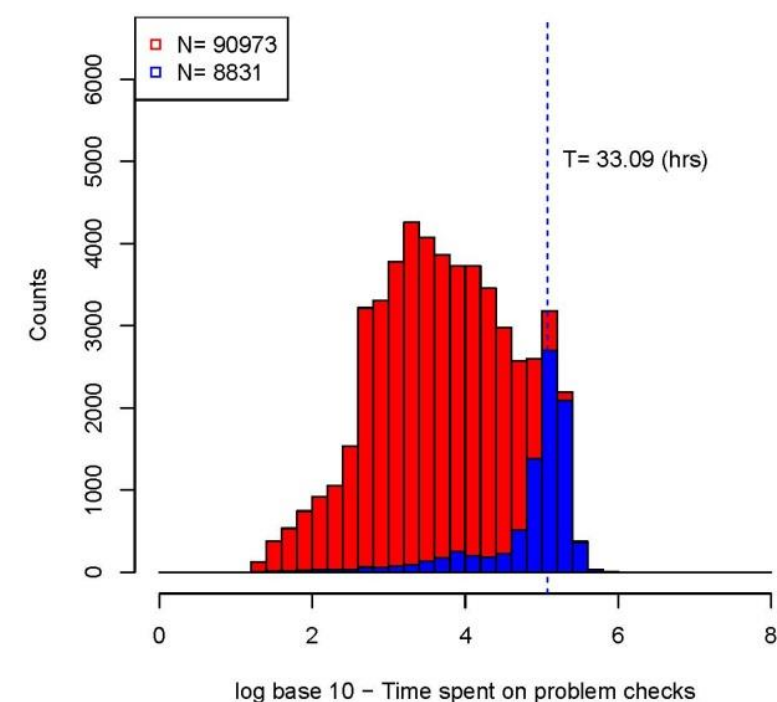
Time spent on unique book page views



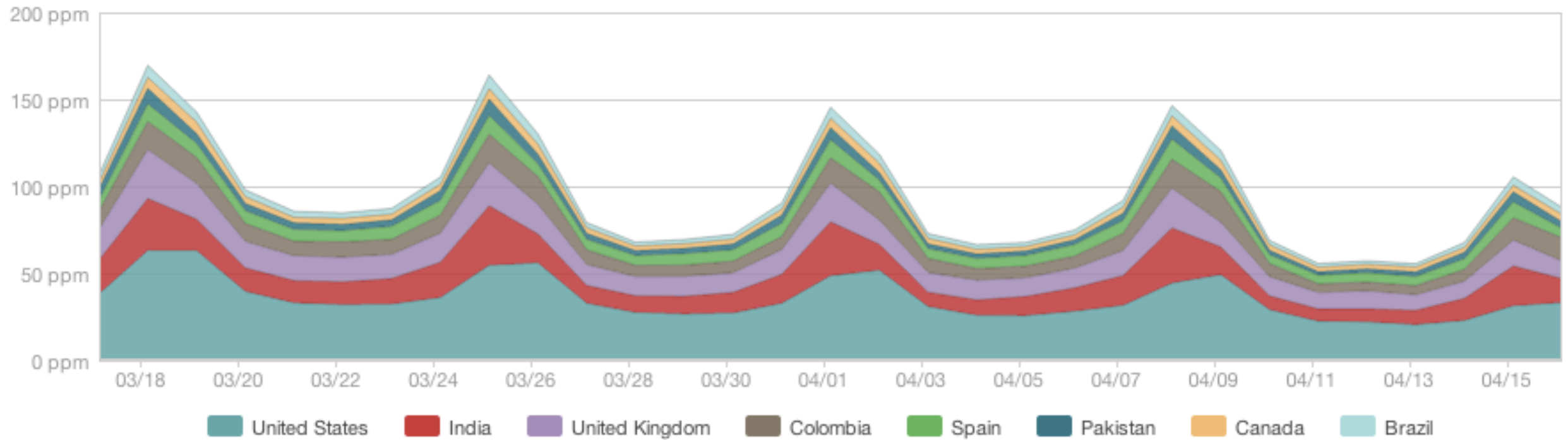
Time spent on load\_video events



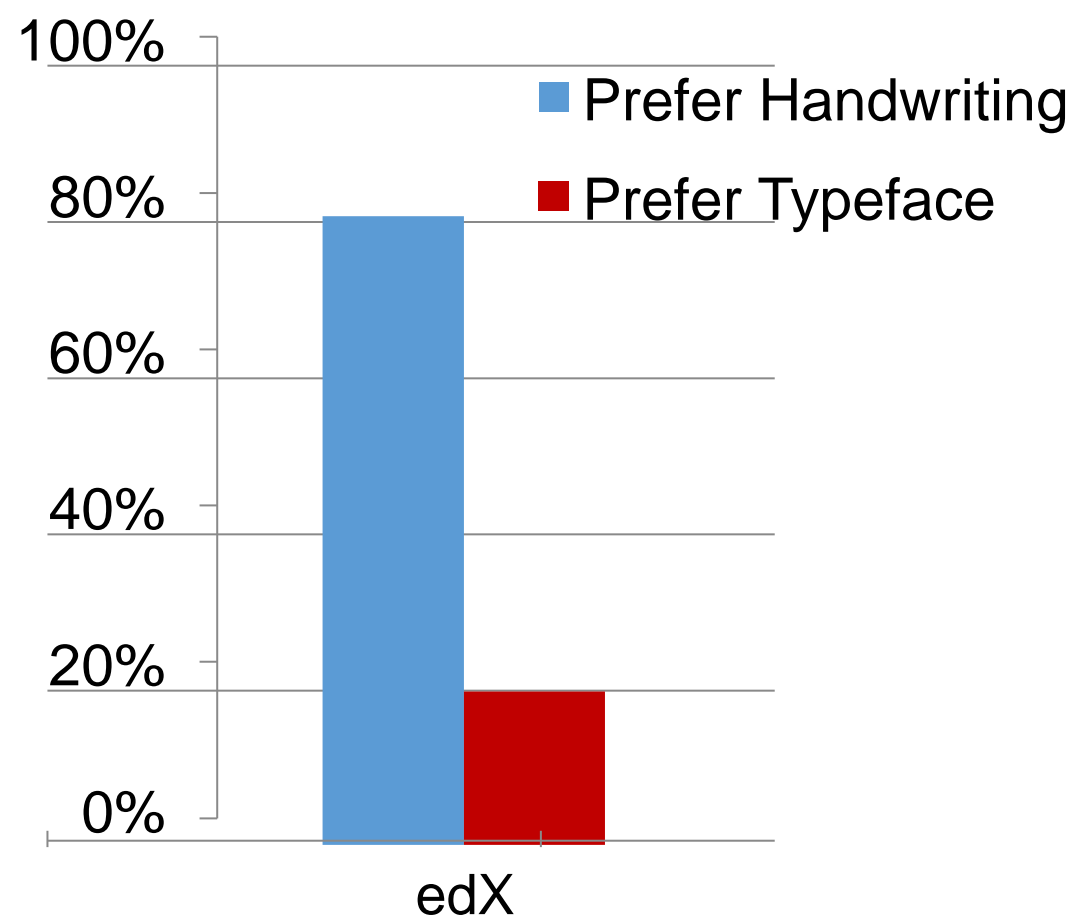
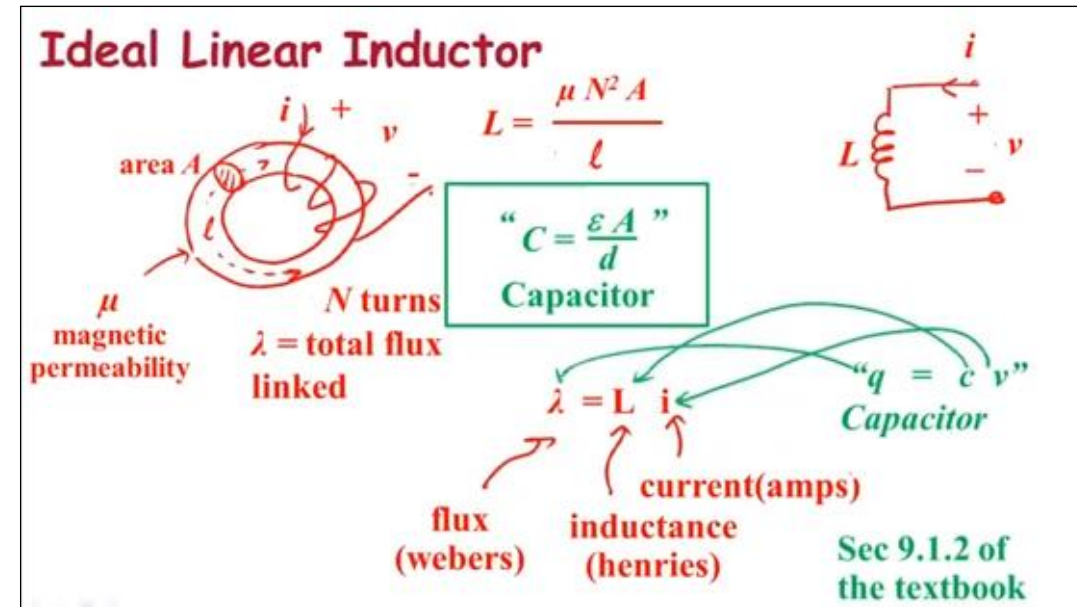
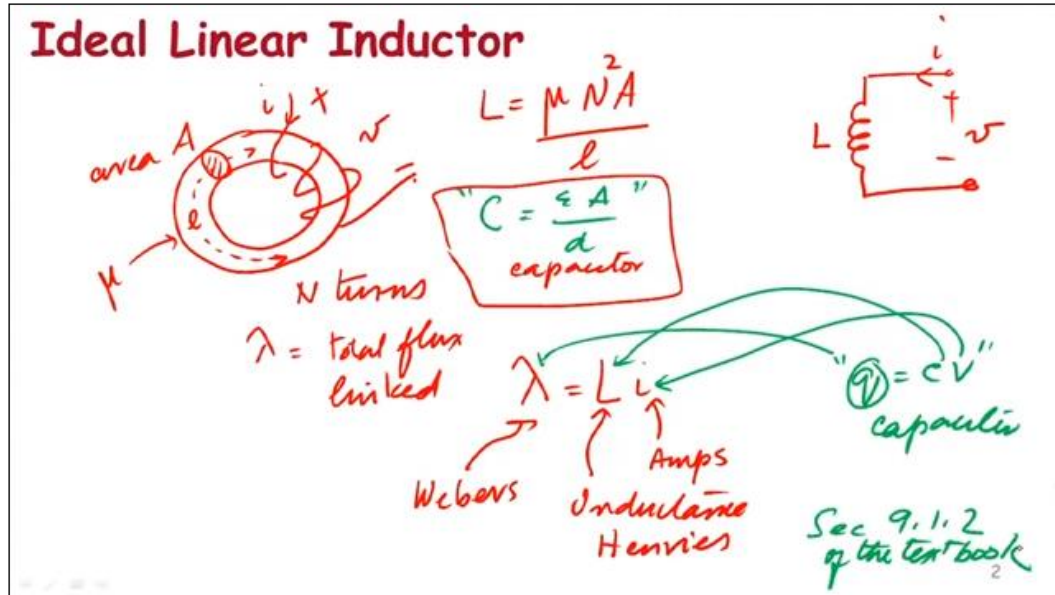
Time spent on problem\_check events



# Learner Activity Profile – Deadlines Work!







The screenshot shows a web browser window with the URL <https://www.edx.org/about/research-pedagogy>. The page features a light blue sidebar on the left and a main content area with three article entries. Each entry includes a logo, a title, a date and author line, and a short summary of the article.

**HarvardX** **Staggered Versus All-At-Once Content Release in Massive Open Online Courses: Evaluating a Natural Experiment**  
HarvardX 24 Sep 2014 By Tommy Mulaney and Justin Reich  
We report on an experiment testing the effects of releasing all of the content in a Massive Open Online Course (MOOC) at launch versus a staggered release. In 2013, HarvardX offered two "runs" of the HeroesX course: In the first, content was released weekly over four months; in the second, all content was released at once. We develop three operationalizations of "ontrackedness" to measure how students participated in sync with the recommended syllabus. Ontrackedness in both versions was low, though in the second, mean ontrackedness was approximately one-half of levels in the first HeroesX. We find few differences in persistence, participation, and completion between the two runs. Controlling for a students' number of active weeks, we estimate modest positive effects of ontrackedness on certification. The revealed preferences of students for flexibility and the minimal benefits of ontrackedness suggest that releasing content all at once may be a viable strategy for MOOC designers. [more](#)

**HarvardX** **Computer-Assisted Reading and Discovery for Student Generated Text in Massive Open Online Courses**  
HarvardX 22 Sep 2014 By Justin Reich, Dustin Tingley, Jetson Leder-Luis, Margaret E. Roberts, Brandon M. Stewart  
Dealing with the vast quantities of text that students generate in a Massive Open Online Course (MOOC) is a daunting challenge. Computational tools are needed to help instructional teams uncover themes and patterns as MOOC students write in forums, assignments, and surveys. This paper introduces to the learning analytics community the Structural Topic Model, an approach to language processing that can (1) find syntactic patterns with semantic meaning in unstructured text, (2) identify variation in those patterns across covariates, and (3) uncover archetypal texts that exemplify the documents within a topical pattern. We show examples of computationally-aided discovery and reading in three MOOC settings: mapping students' self-reported motivations, identifying themes in discussion forums, and uncovering patterns of feedback in course evaluations. [more](#)

**IRR ODL** **Learning in an Introductory Physics MOOC: All Cohorts Learn Equally, Including an On-Campus Class**  
The International Review of Research in Open and Distance Learning 1 Sep 2014 By Kimberly F Colvin, John Champaign, Alwina Liu, Qian Zhou, Colin Fredericks, and David E Pritchard  
The recent release of hundreds of free online courses in MOOCs (massive open online courses) by organizations such as Coursera, edX, and Udacity has been so dramatic that an article in the New York Times proclaimed 2012 the "Year of the MOOC" (Pappano, 2012). These MOOCs, often digitizations of standard, relatively introductory courses from top 50 universities (and especially MIT, Harvard, Berkeley, and Stanford), have provoked multidimensional discussions and special issues of various publications. Nevertheless, few studies have attempted to use MOOC data to address the central question: "is there learning in MOOCs?" [more](#)

**SJSU SAN JOSE STATE UNIVERSITY** **The Transformative Potential of Blended Learning Using MIT edX's 6.002x Online MOOC Content Combined with Student Team-Based Learning in Class**



# Imagining the Future of Higher Ed with Zero Marginal Cost

# Unbundling Time



Open admission – everyone welcome  
Learn for free  
Pay for credit if you pass







# Unbundled Credentials

## MIT MicroMasters





# Unbundled Content

## Blended Learning at San Jose State University

**FALL 2012 COMPARED TO SPRING 2012**  
Course retake rates drop from **41% to 9%**

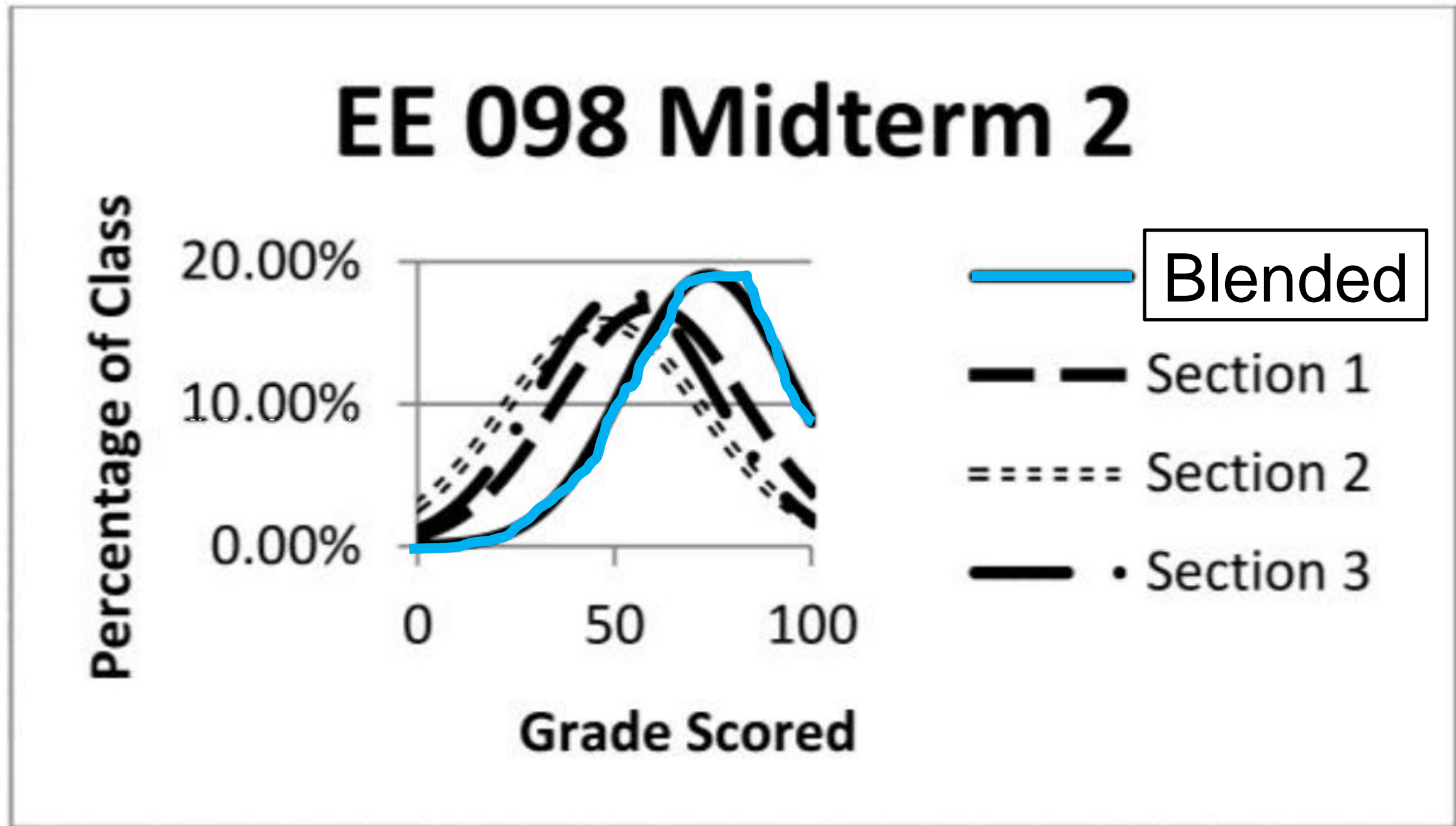
Success in Spr 2013, Fall 2013, Spr 2014 too

Source: San Jose State University Davidson College of Engineering

32



# Grades Curve Shift



Is the future of education  
**unbundled?**



What should accreditation look like in an unbundled world?