Students, Systems, and Interactions: Synthesizing the First Four Years of Learning@Scale and Charting the Future

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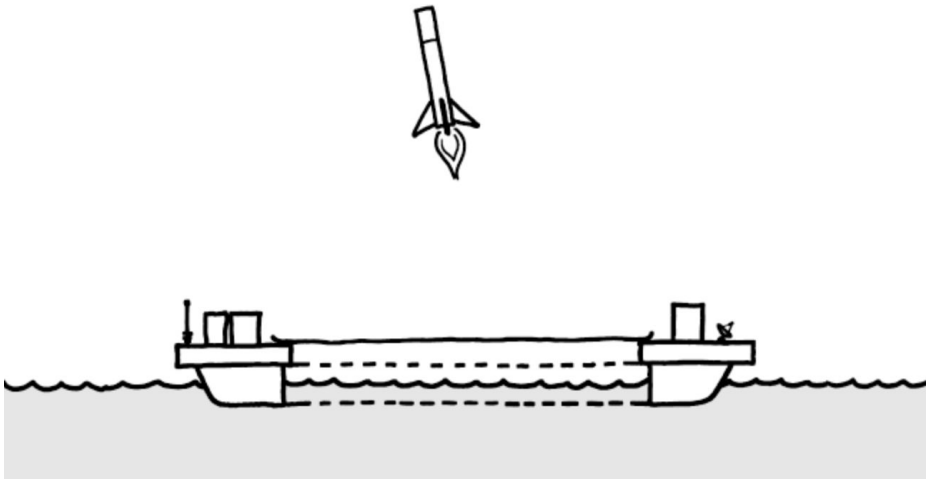
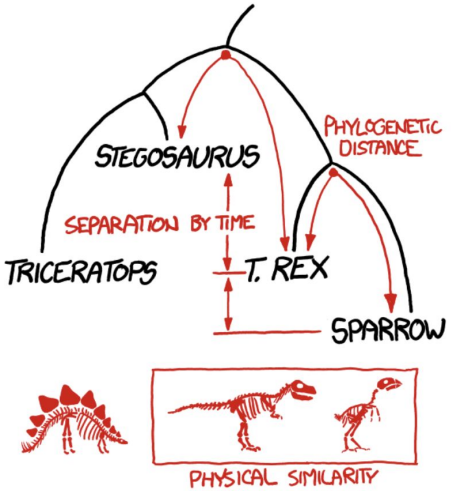
The Design Lab

Pushing the Limits



Taxonomy

- Systems for Learning at Scale
  - One-to-One Systems
  - One-to-Many Systems
  - Many-to-Many and Automated Systems
- Interactions with Sociotechnical Systems
  - Individual Interactions with Learning Technologies
  - Group Interactions within Online Learning Communities
- Understanding Online Students
  - Modeling Student Knowledge
  - Promoting Global Access and Equity



One-to-One Systems

PeerStudio: Rapid Peer Feedback Emphasizes Revision and Improves Performance

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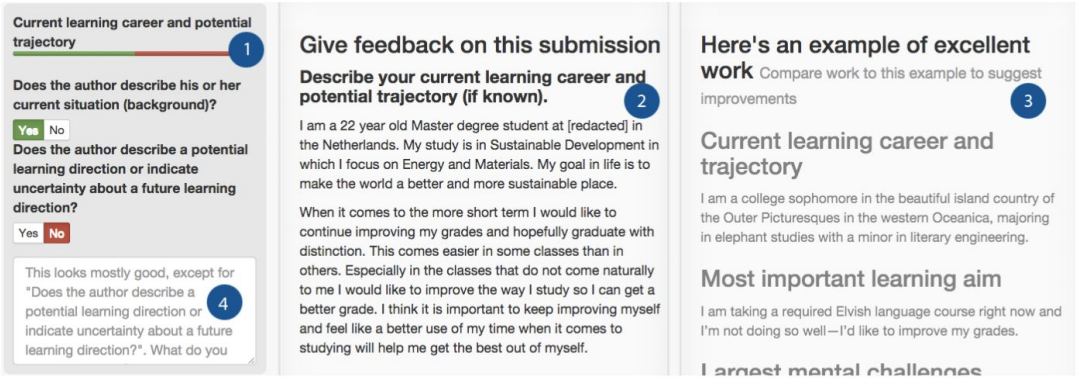
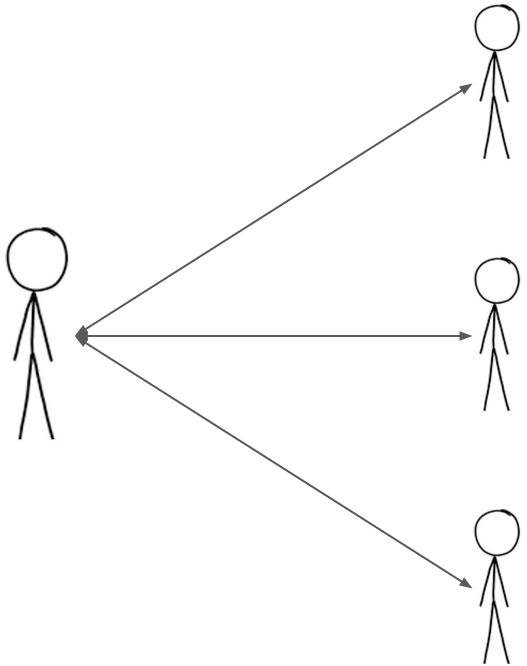


Figure 1: PeerStudio is a peer learning platform for rapid, rubric-based feedback on drafts. The reviewing interface above shows (1) the rubric, (2) the student draft, (3) an example of excellent work to compare student work against. PeerStudio scaffolds reviewers with automatically generating tips for commenting (4).

- Peer grading systems form the backbone of many online courses.
- Building systems to enable students to rapidly give and receive feedback allows them to quickly practice new skills.

One-to-Many Systems



Divide and Correct: Using Clusters to Grade Short Answers at Scale

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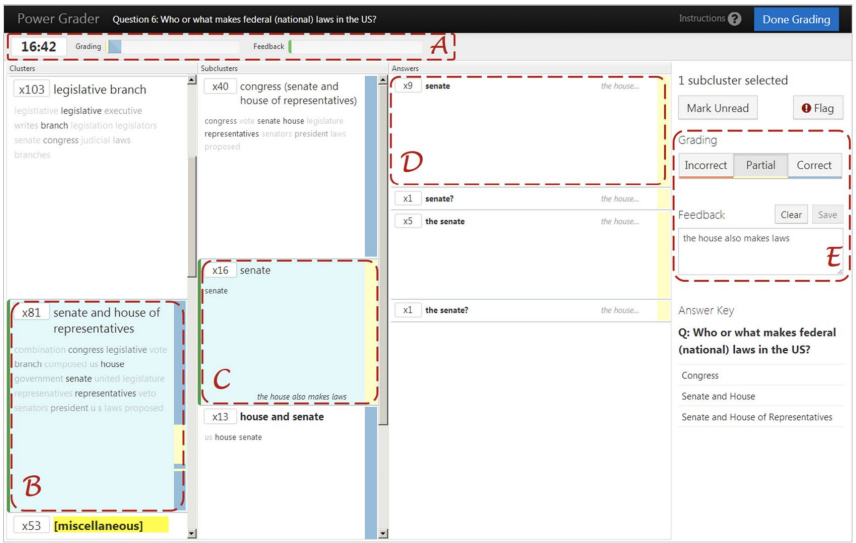

Figure 1: Grading a cluster in Question 6. (A) progress bars; (B) a cluster of 81 students, graded mostly correct (blue); (C) the selected subcluster, graded partially correct (yellow); (D) the answer "senate" by 9 students; (E) grading and feedback controls.

Writing Reusable Code Feedback at Scale with Mixed-Initiative Program Synthesis

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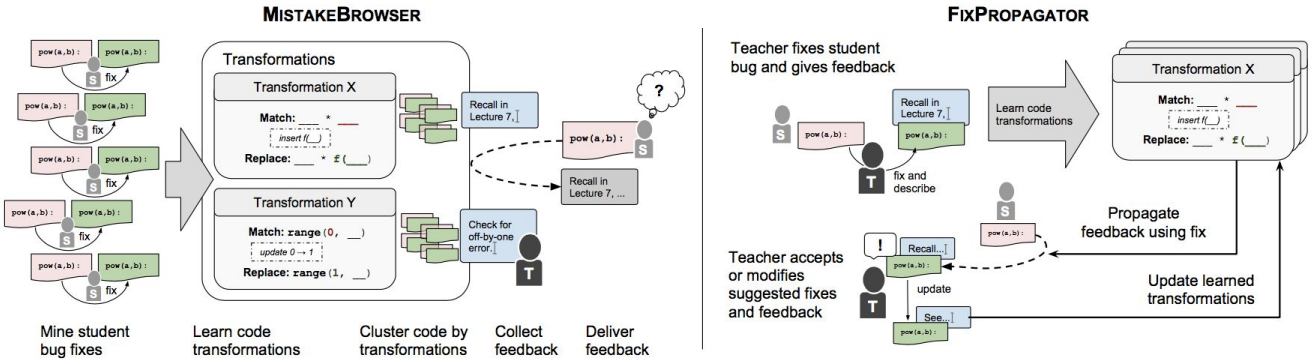
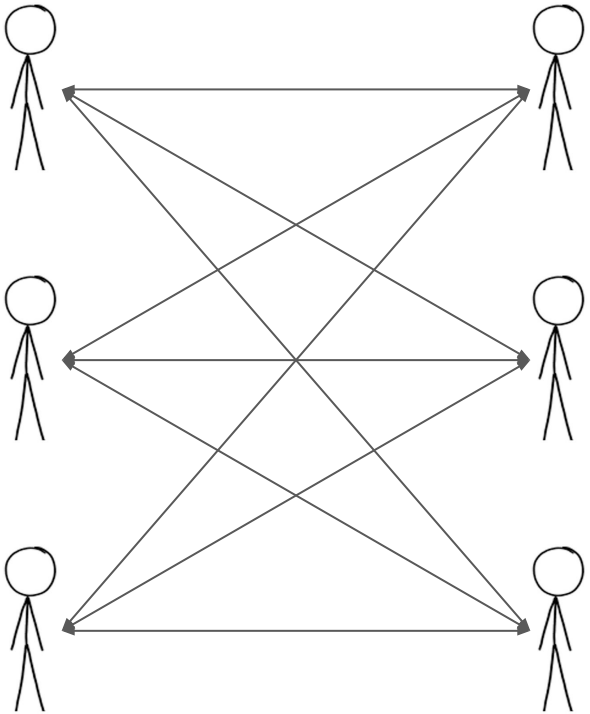


Figure 1. We contribute two interfaces that help teachers give feedback on incorrect student submissions using program synthesis. MISTAKEBROWSER learns code transformations from examples of students fixing bugs in their own code. Using these transformations, MISTAKEBROWSER clusters and fixes current and future incorrect submissions. The teacher adds feedback, one cluster at a time. FIXPROPAGATOR learns code transformations from examples of teachers fixing bugs in incorrect student submissions. The teacher annotates each fix with feedback. Using these annotated transformations, FIXPROPAGATOR propagates fixes and feedback to current and future incorrect submissions.

- Experts can effectively scale their reach by using data to direct their feedback to clusters of students.

Many-to-Many and Automated Systems



AXIS: Generating Explanations at Scale with Learnersourcing and Machine Learning

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An Automated Grading/Feedback System for 3-View Engineering Drawings using RANSAC

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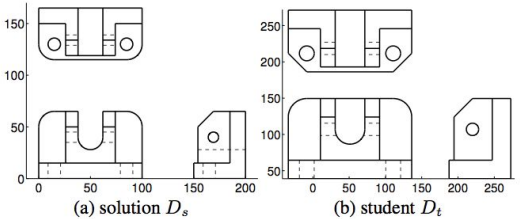

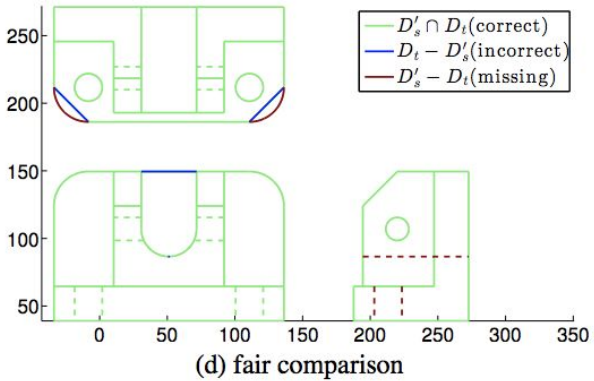

Figure 8. Comparing the solution to a student's drawing. To be compared to D_t, all views in D_s are scaled 1.7 times larger. The top, front, and right views are translated (-33.8, +186.2), (-33.8, +39), and (+187.7, +39), respectively. All views have zero rotation and skew. By aligning them, the algorithm finds incorrect and missing lines, which are represented in blue and dark red.

Problems Before Solutions: Automated Problem Clarification at Scale

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```
===================================================================
Assignment: Project 1: Hog
OK, version v1.3.10
===================================================================

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Unlocking tests

At each "? ", type what you would expect the output to be.
Type exit() to quit

---------------------------------------------------------------------
Question 1 > Suite 1 > Case 1
(cases remaining: 4)

>>> roll_dice(2, make_test_dice(4, 6, 1))
? 3
-- Not quite. Try again! --

? 10
-- OK! --

---------------------------------------------------------------------
```

Figure 1. An unlocking session where the student wishes to unlock question 1, initially provides an incorrect response, then provides a correct response.

- Automated systems allow students to experiment.
- Experimentation and early correction creates a safer environment for failure.

Individual Interactions with Learning Technologies

Student Skill and Goal Achievement in the Mapping with Google MOOC

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1. *No-shows*: students register for the course (usually before the course content is available) but never log in to the course to interact with the content
2. *Observers*: want to see what an online course is like or how this one is taught
3. *Casual learners*: want to learn one or two new things, either out of curiosity or a work/school-related need
4. *Completers*: complete as many course elements necessary to complete projects and earn a certificate of completion

Demographic Differences in How Students Navigate Through MOOCs

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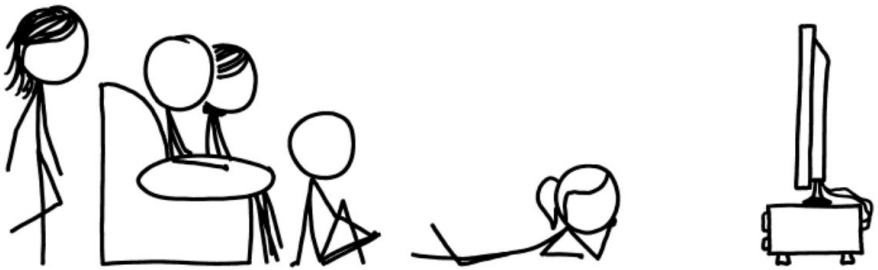
Certificate earners view only 78% of learning sequences, on average; they completely skip 22% of course content.
Certificate earners engage in non-linear navigation behavior, often jumping backward to revisit earlier lectures.
Navigation backjumps from assessments to lectures are more common than lecture-to-lecture backjumps.
Older students and those from countries with lower student-teacher ratios (e.g., the US and European countries) visit and repeat more lecture sequences, which indicates more non-linear navigation and learning strategies.
Younger students and those from countries with higher student-teacher ratios (e.g., India, Kenya) visit and repeat fewer sequences, which indicates more linear navigation.
However, the effect of age is stronger than that of country; older students from countries with higher student-teacher ratios behave more like their similarly-aged counterparts in countries with lower student-teacher ratios.

Table 1. Summary of the main findings that we present in this paper.

- Students come into online courses with diverse goals, so course designers should make materials easy to access along non-linear and incomplete paths.

Group Interactions within Online Communities



The Role of Social Media in MOOCs: How to Use Social Media to Enhance Student Retention

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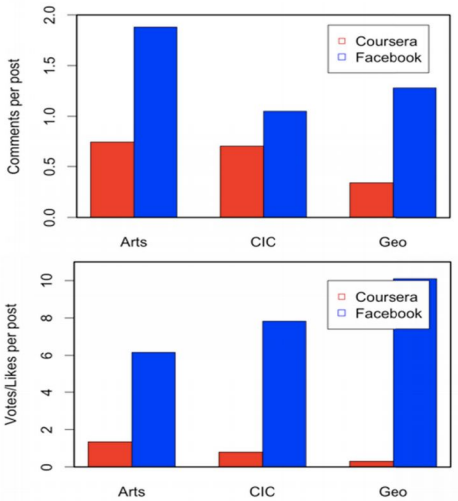

Figure 1. Summary of commenting (top) and Voting/Liking (bottom) activities.

"What we need is a place to collaborate on our group project but Coursera is really not an ideal one. Since there is no collaboration feature on Coursera, we appropriated the forum and added a new thread on the forum to divide some place for our project discussion. But we cannot control the access to the thread. We experienced lots of interruptions. So we gave up and adopted Facebook." [P8]

"I lost my interests in the Coursera forum after one week because it was very chaos. I didn't know people there because I guess most of them were not willing to make friends. They used fake name, which made me feel untrusted. So later, I used a fake name too. Also, I rarely received replies from them on Coursera and when I answered some questions, no thanks received. It's not like a human being interaction place. So I went to Facebook group, where I saw a totally different atmosphere… "[P3]

Chatrooms in MOOCs: All Talk and No Action*

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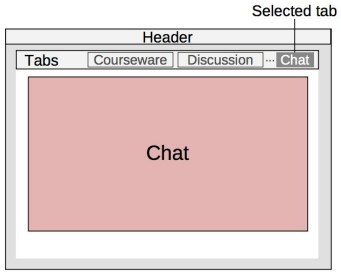
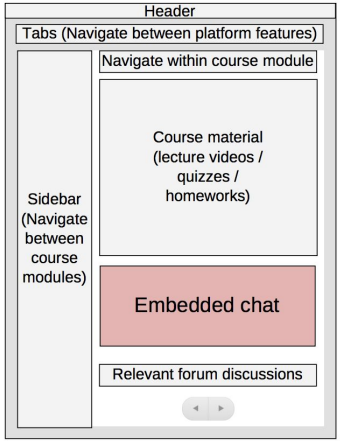


(a) Chat tab interface, accessible to both the "chat tab" and "embedded chat" groups by clicking the "Chat" button in the upper right. The chat panel is wider and taller than the embedded chat, filling most of the browser window.

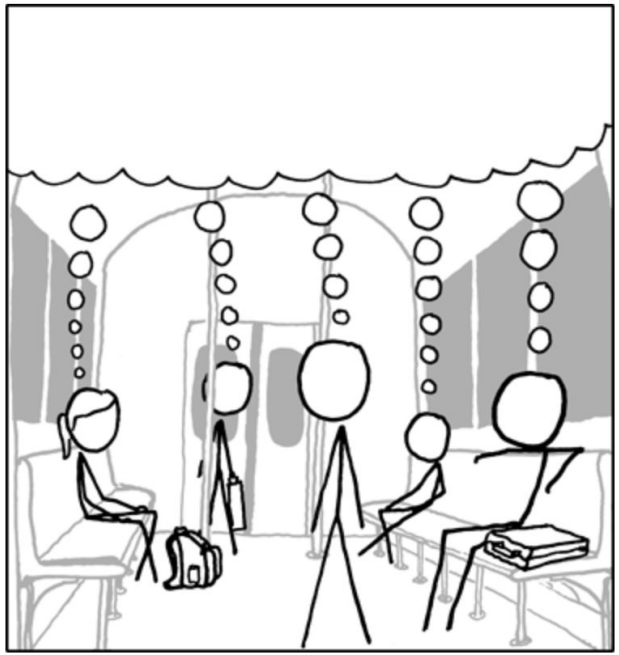
(b) Web chat interface, based on `qwebirc`. Messages with times are on the left, users are on the right, and messages are entered at bottom. Names have been changed.



(c) Embedded chat interface, accessible only to the "embedded chat" group. A smaller chat panel is presented below the lecture, quiz, or homework the student is currently interacting with. In some cases, the student may need to scroll to see it. If the student is not in the "embedded chat" group, the chat panel is hidden but the page is otherwise identical.

- Learning is an inherently social experience.
- A healthy community engenders trust and encourages knowledge-sharing.

Modeling Student Knowledge



Learning Transfer: does it take place in MOOCs?

An Investigation into the Uptake of Functional Programming in Practice

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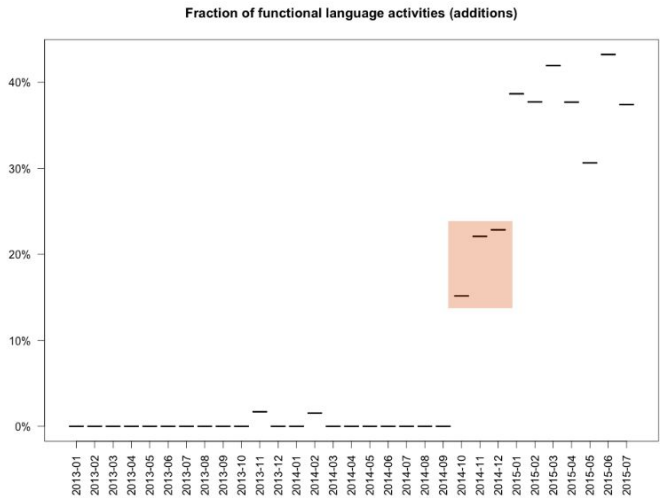

Figure 6. Fraction of functional programming activities among the 336 engaged Novice Learners with functional activities after FP101x. FP101x ran during the highlighted region.

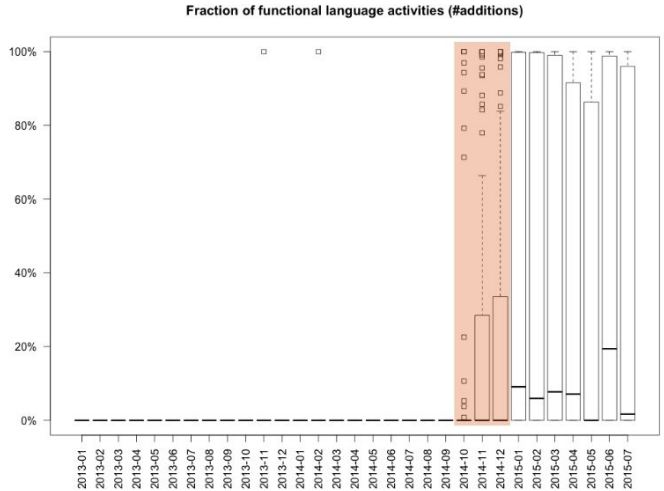

Figure 7. Distribution of functional programming activities among the 336 engaged Novice Learners with functional activities after FP101x. FP101x ran during the highlighted region.

Probabilistic Use Cases: Discovering Behavioral Patterns for Predicting Certification

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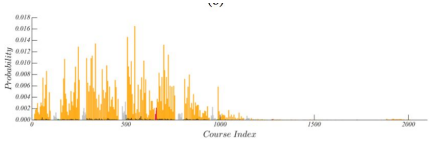
(c)



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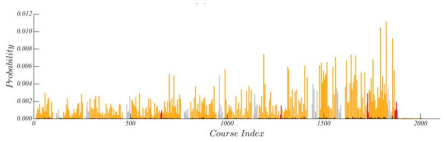

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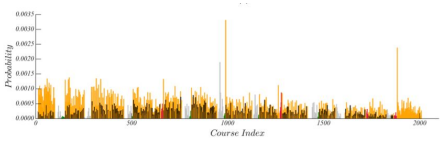

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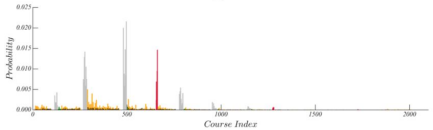

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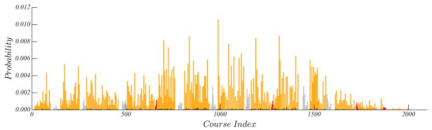

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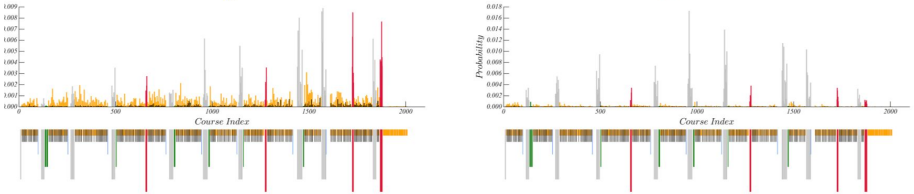
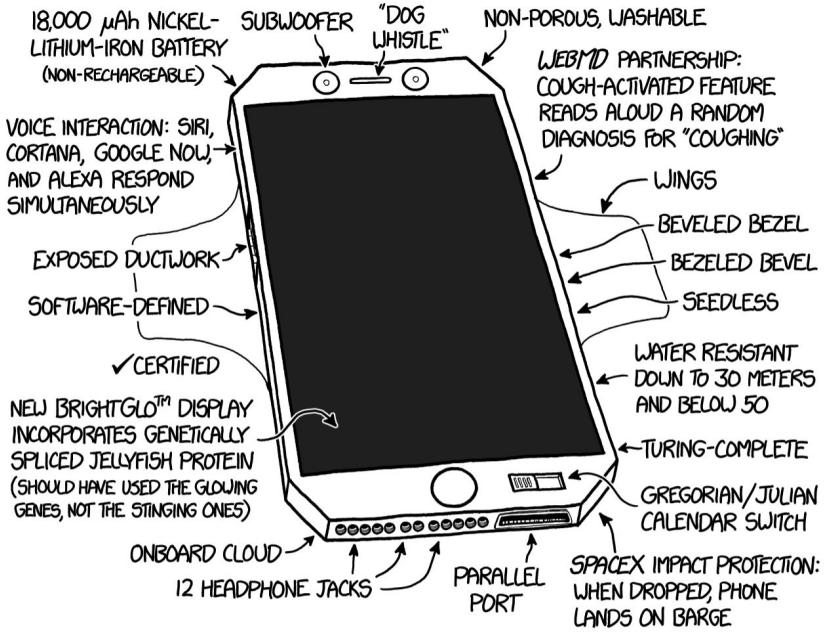


(i)

(j)

- We have abundant techniques for modeling student knowledge.
- What are effective and practical methods to deploy them at scale and measure their efficacy?

Promoting Global Access and Equity



Mobile Devices for Early Literacy Intervention and Research with Global Reach

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Figure 1: Children at our deployment sites using the tablets together. From left to right, in a remote Ethiopian village, in a school in South Africa and in a preschool in Alabama.

- **Work without an Internet connection** by buffering data and providing alternate transmission paths.
- **Support remote administration** including the ability to monitor device health and remotely update content.
- **Simplify maintenance and administration** to support technical and non-technical local support personnel.
- **Provide a path to scalability** of a large number of sites and tablets.
- **Limit usage to educational content**, thus making it more accessible to a pre-literate population as well as reducing risk of theft.

Towards Equal Opportunities in MOOCs: Affirmation Reduces Gender & Social-class Achievement Gaps in China

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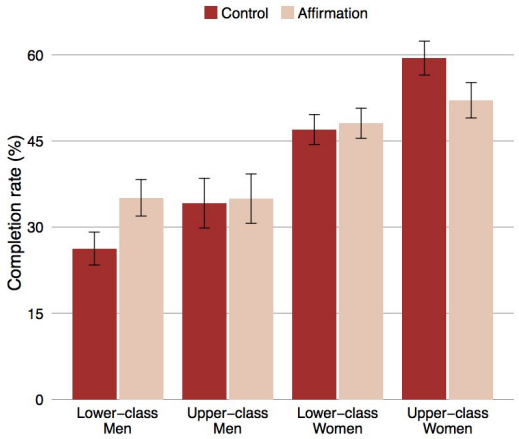


Figure 2. Mean course completion rate in each experimental condition by participant gender and social class. Affirmation raised completion rates exclusively for lower-class men. The drop in completion for upper-class women was not statistically significant. Error bars are ±1SE.

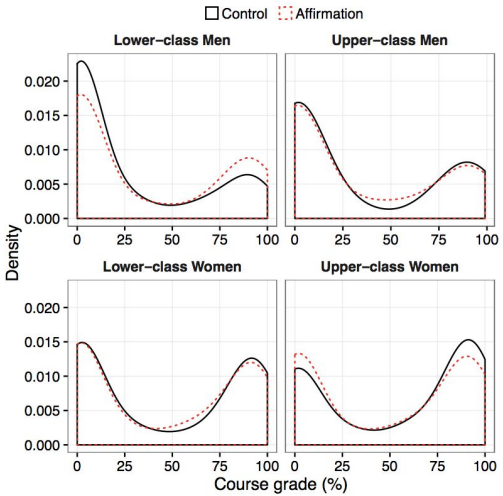
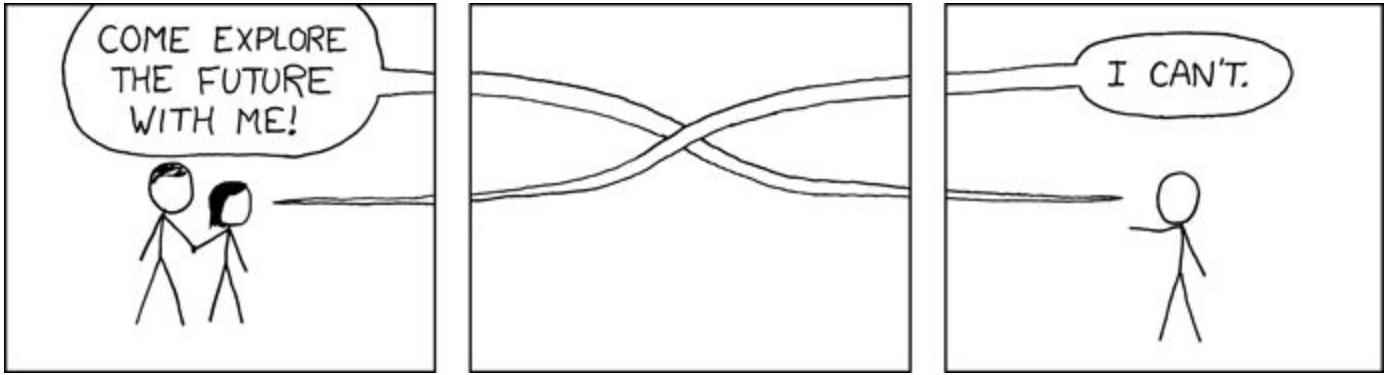


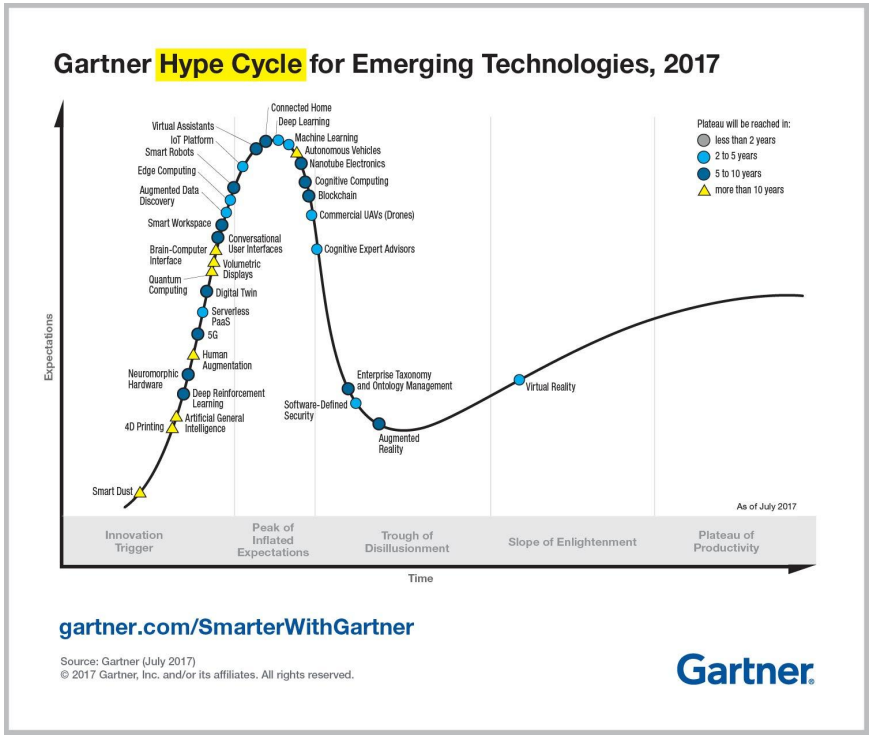
Figure 3. Grade distribution in each experimental condition by participant gender and social class.

- Modern learner populations are globally diverse, so it is important to empirically investigate new ideas about student identity and the settings in which they are learning.

Charting the Future



Beyond the MOOC Hype Cycle



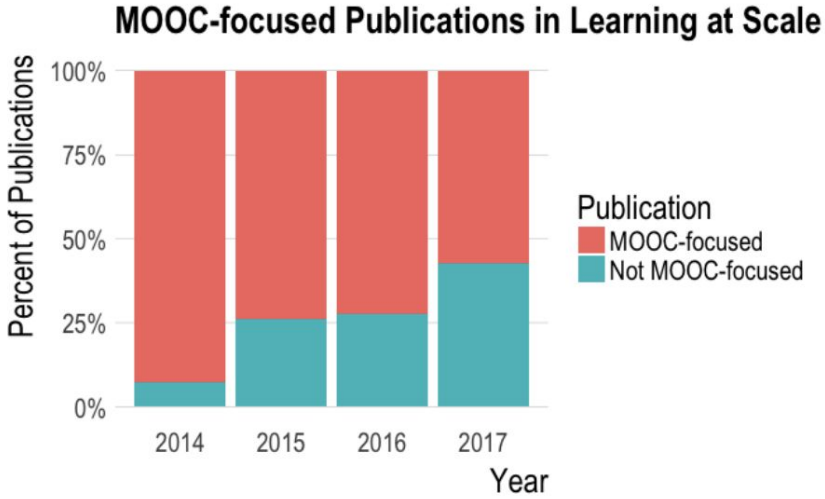


Figure 1. Learning at Scale has become less focused on MOOCs as the years progressed. MOOCs will still probably be an important part of online education in the foreseeable future, but we are just beginning to explore the variety of substrates that make scaled learning possible.

The Axes of Scale for Online Learning Systems

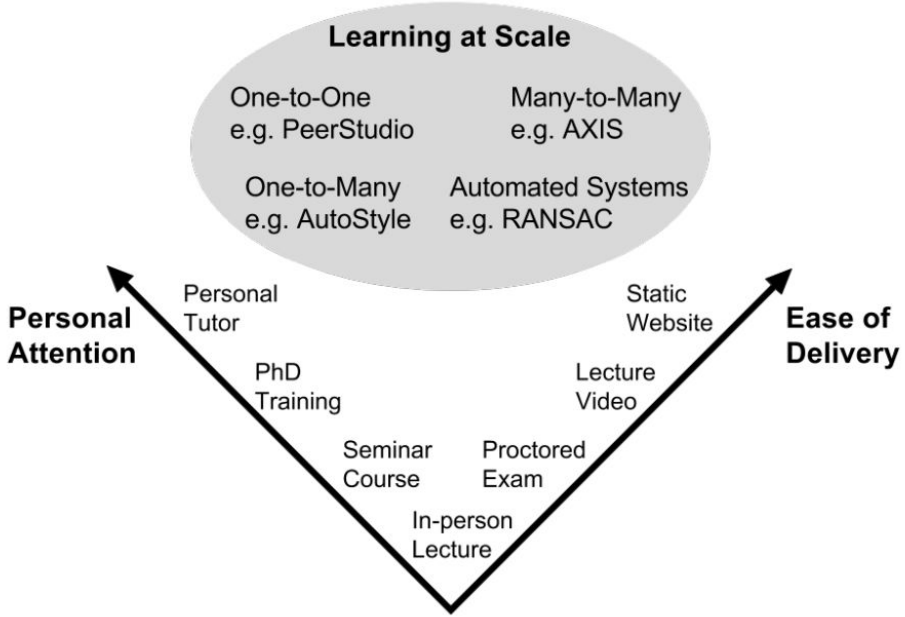
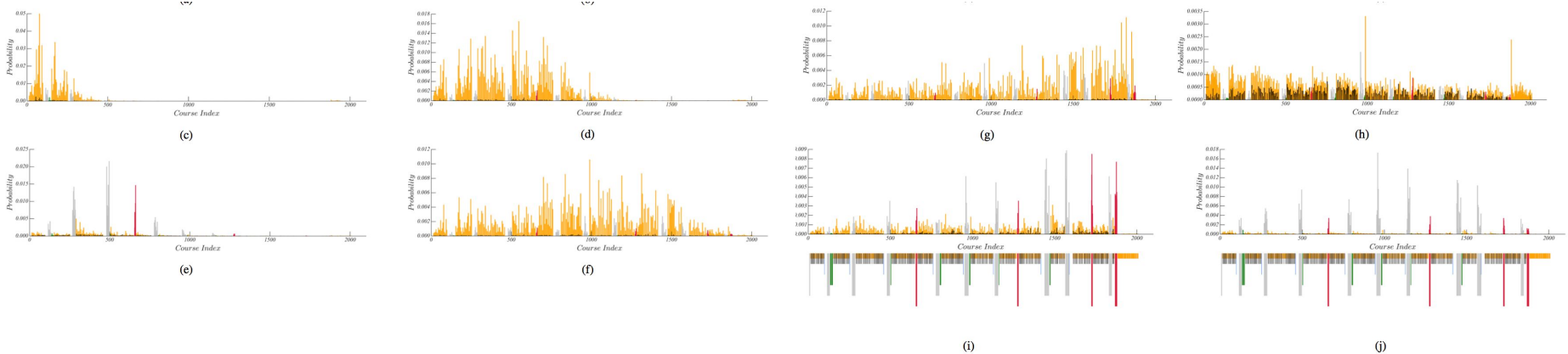
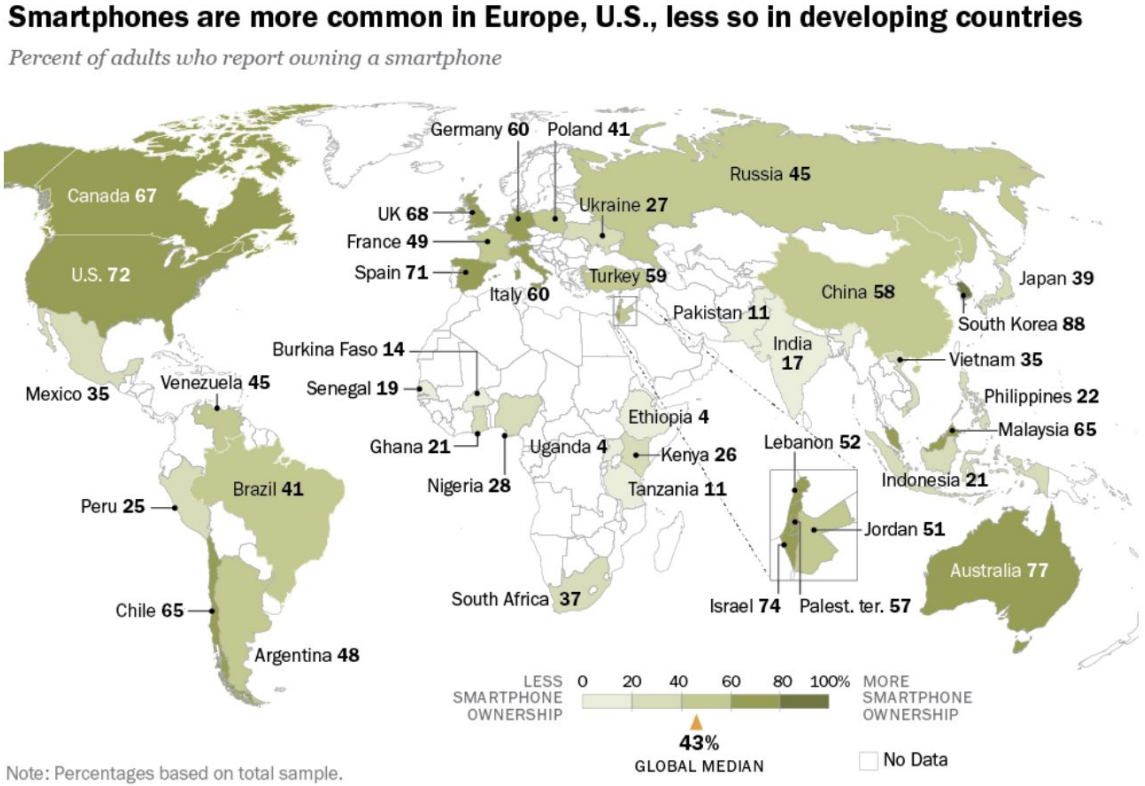


Figure 2. Personal attention and ease of delivery are two important considerations for designing educational experiences. One main goal of Learning at Scale is to contribute novel research that push toward the top of this graph with systems that maximize both dimensions of scale.

Addressing More Diverse Student Personas



The Future is in Mobile Devices



Fostering Better Social Connections in Online Courses

Collaboration in the Open Classroom CSCW 2015, March 14-18, 2015, Vancouver, BC, Canada

Talkabout: Making Distance Matter with Small Groups in Massive Classes

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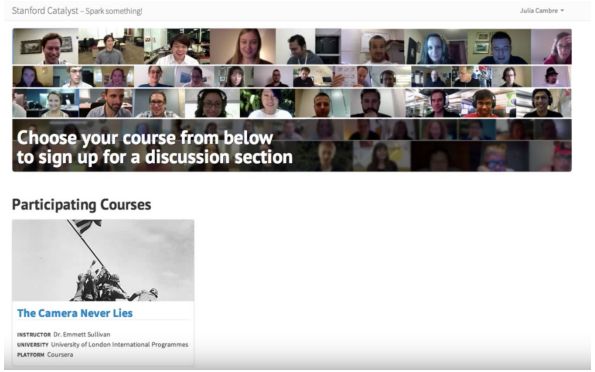

Thank You!

Questions?

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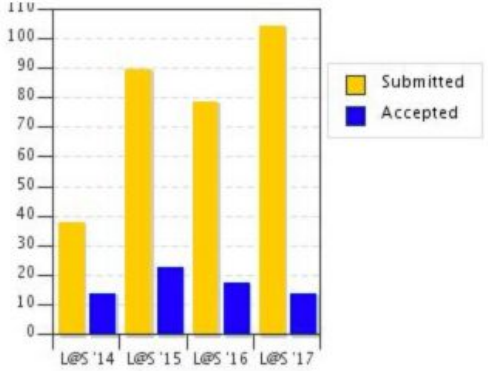
UC San Diego
The Design Lab

1. Taxonomy
2. Synthesis
3. Future Directions

Proceedings of the first ACM c ×

Sean

Secure | https://dl.acm.org/citation.cfm?id=2556325



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