MOOCs
and the
Science of Learning

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Don’t measure clicks.

Measure learning.

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KHANACADEMY | Subjects | Coach | Search for subjects, skills, and videos | Home | 4 | Justin Reich

Your students | Dashboard | Manage Students | Student Progress | Skill Progress | **Grid** | Activity | Real Time

Class: **Workshop** | Filter: **Find topics or skills** | ☐ **Struggling**

Student status	erting als to ents	Converting percents to decimals	Finding percents	Rounding decimals	Fractions as division by 10 or 100	Understanding moving the decimal	Divisibility tests	Prime numbers	Composite numbers	Place value
Alisa Barnard										
bfreitas										
chopkins										
David Brundage										
Erin McCloskey										
http://facebookid.khanacademy.org/586303638										
Justin Reich										
MKreppel										
myates										
pdepaolo										
Peter Nilsson										
plaohakul										
pwarsaw										
robert_hilliker										

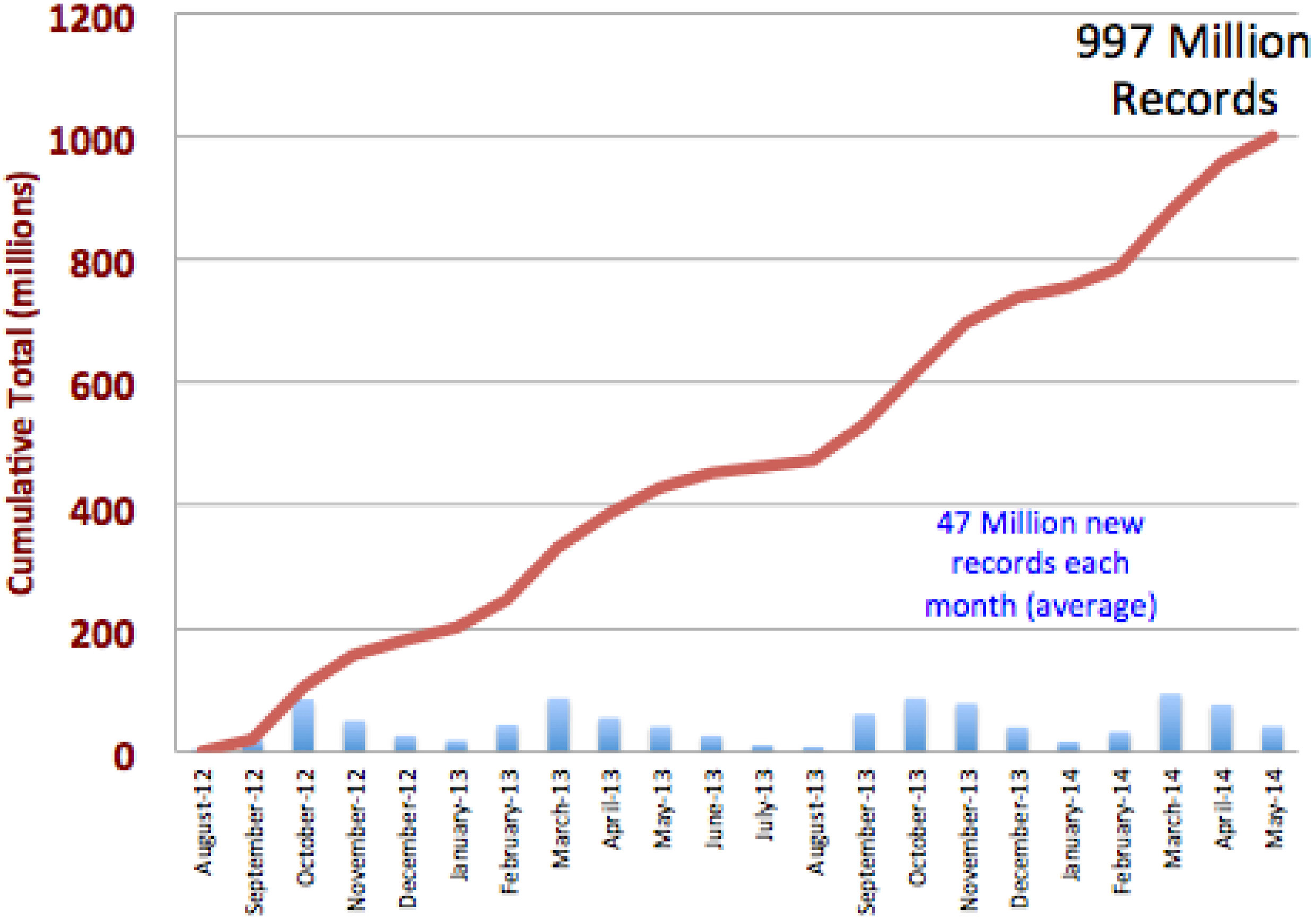
robert_hilliker
Converting decimals to percents
Status: Needs Practice
Last attempted: Never
Problems attempted: 0

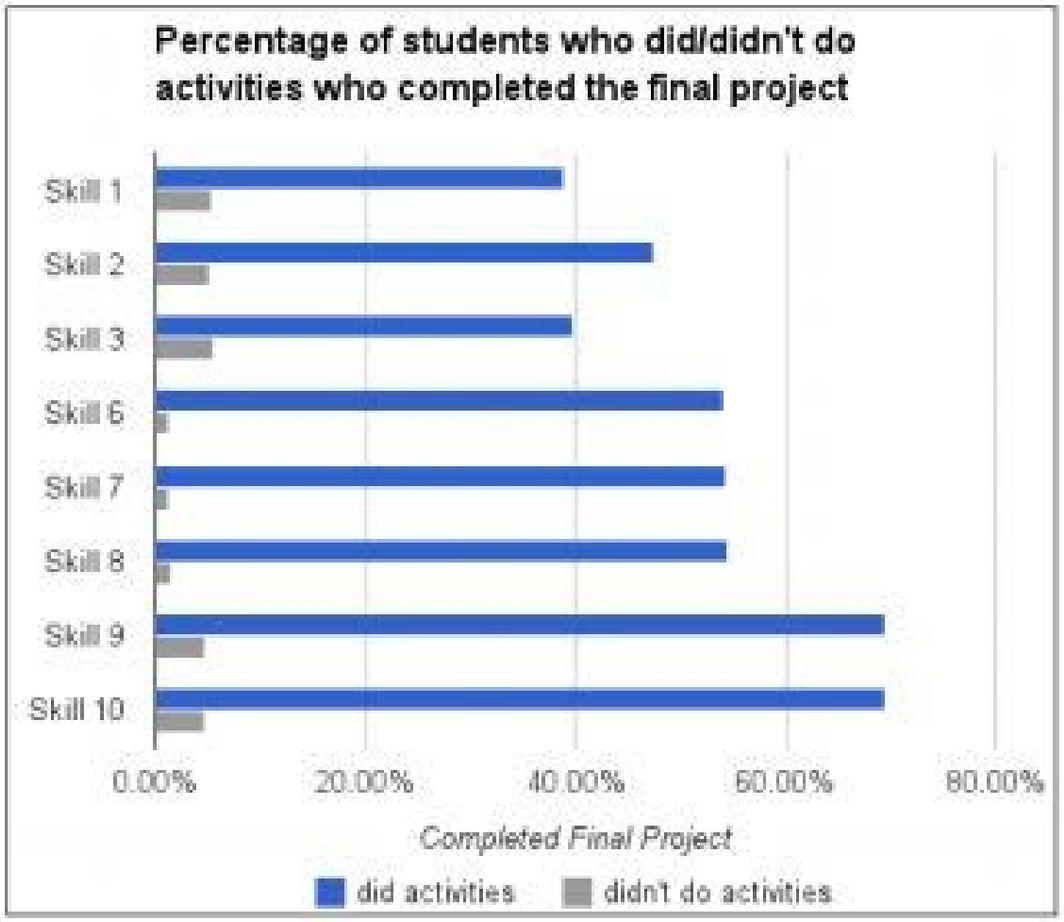
A hypothesis:
We have terabytes of data about what students click,

but little understanding about what changes in their heads.

image from Berklee School of Music

MITx Learner Data from edX: Number of Records by Month



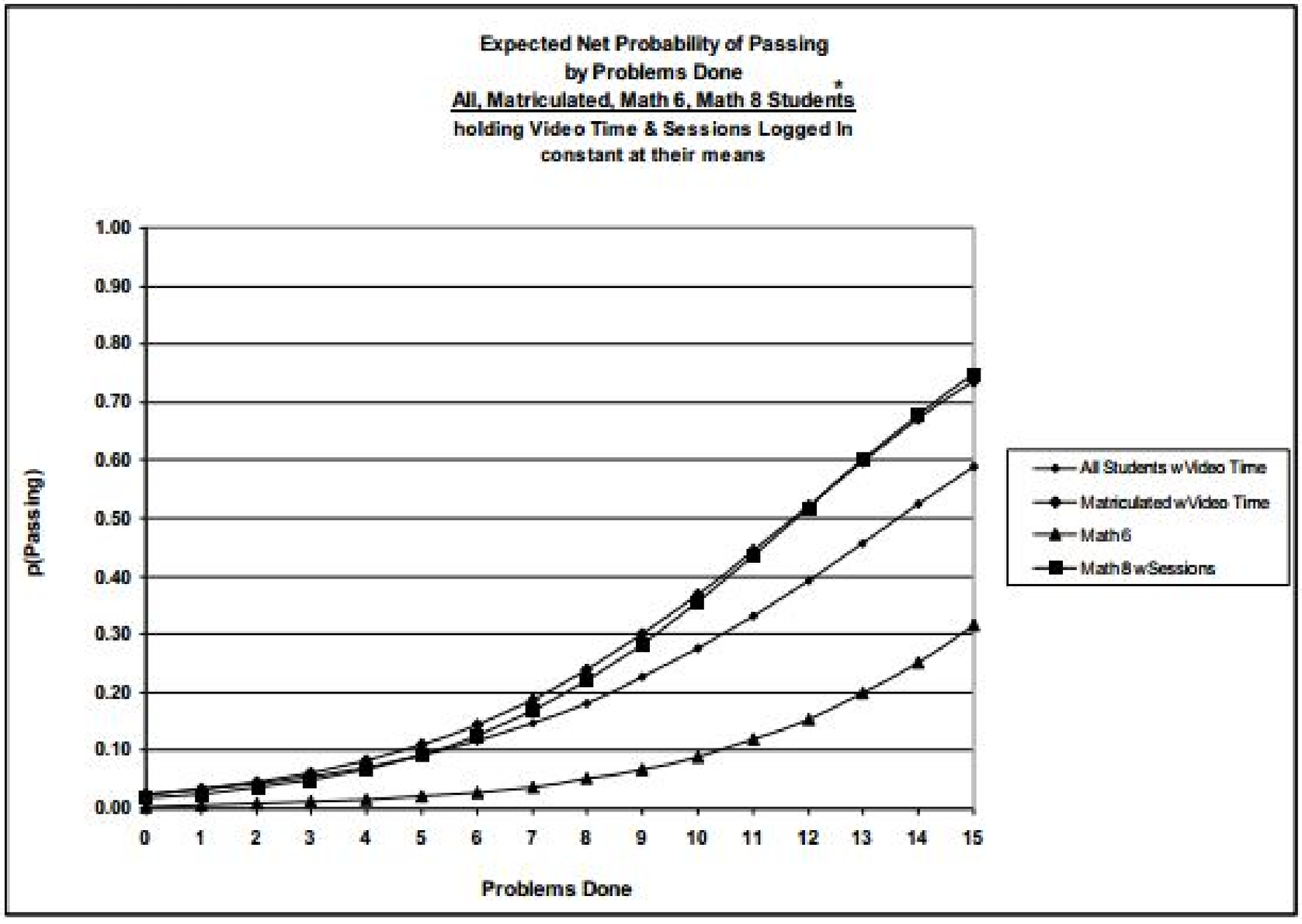


	Did Activities	Didn't Do Activities
Skill 1	39.01%	5.45%
Skill 2	47.53%	5%
Skill 3	39.83%	5.51%
Skill 6	54.07%	1%
Skill 7	54.29%	1%
Skill 8	54.50%	1%
Skill 9	69.58%	4.62%
Skill 10	69.58%	4.62%

Figure 3. Students who did activities and did not do activities who completed final projects

From Wilkowski, Deutsch, Russell, (2014) Student Skill and Goal Achievement in the Mapping with Google MOOC

Figure 4. Expected Net Increase in Probability of Passing with Increase in Problems Done



* All variables are listed by model in the appendix. The graphed variables show effect net of the other variables' effects. A model's significant variables not included in a graph are being held constant at their mean values for each student group.

from Collins (2013), AOLE Report

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The primary conclusion from the model, in terms of importance to passing the course, is that measures of student effort eclipse all other variables examined in the study, including demographic descriptions of the students, course subject matter and student use of support services. Although support services may be important, they are overshadowed in the current models by students' degree of effort devoted to their courses. This overall finding may indicate that accountable activity by students--problem sets for example--may be a key ingredient of student success in this environment.

Students who do things in class, pass.

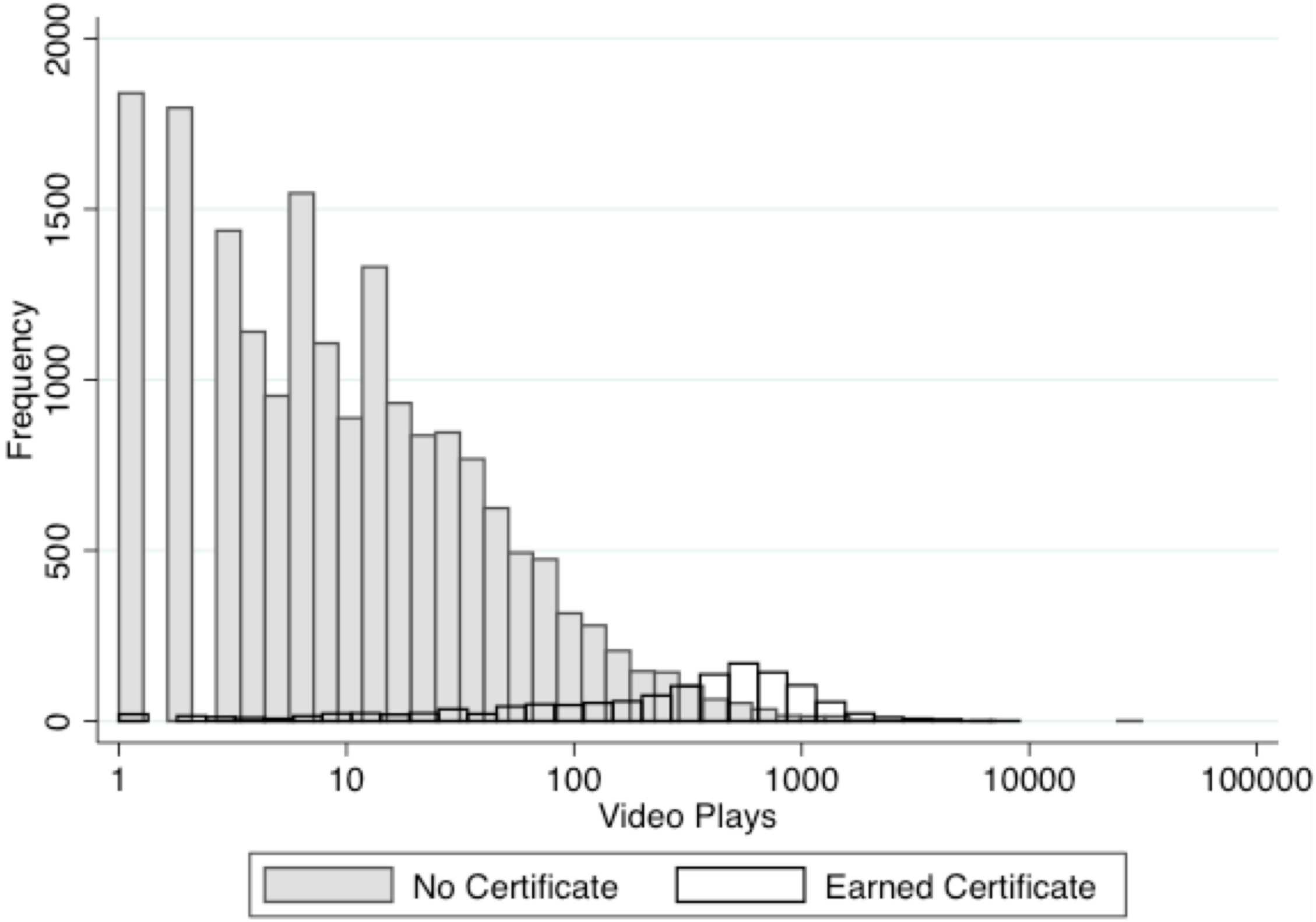


Figure 12: Video play events as captured by edX video player log data for 1,307 certificate earners and 15,008 non certificate-earners who viewed at least one video in the edX player.

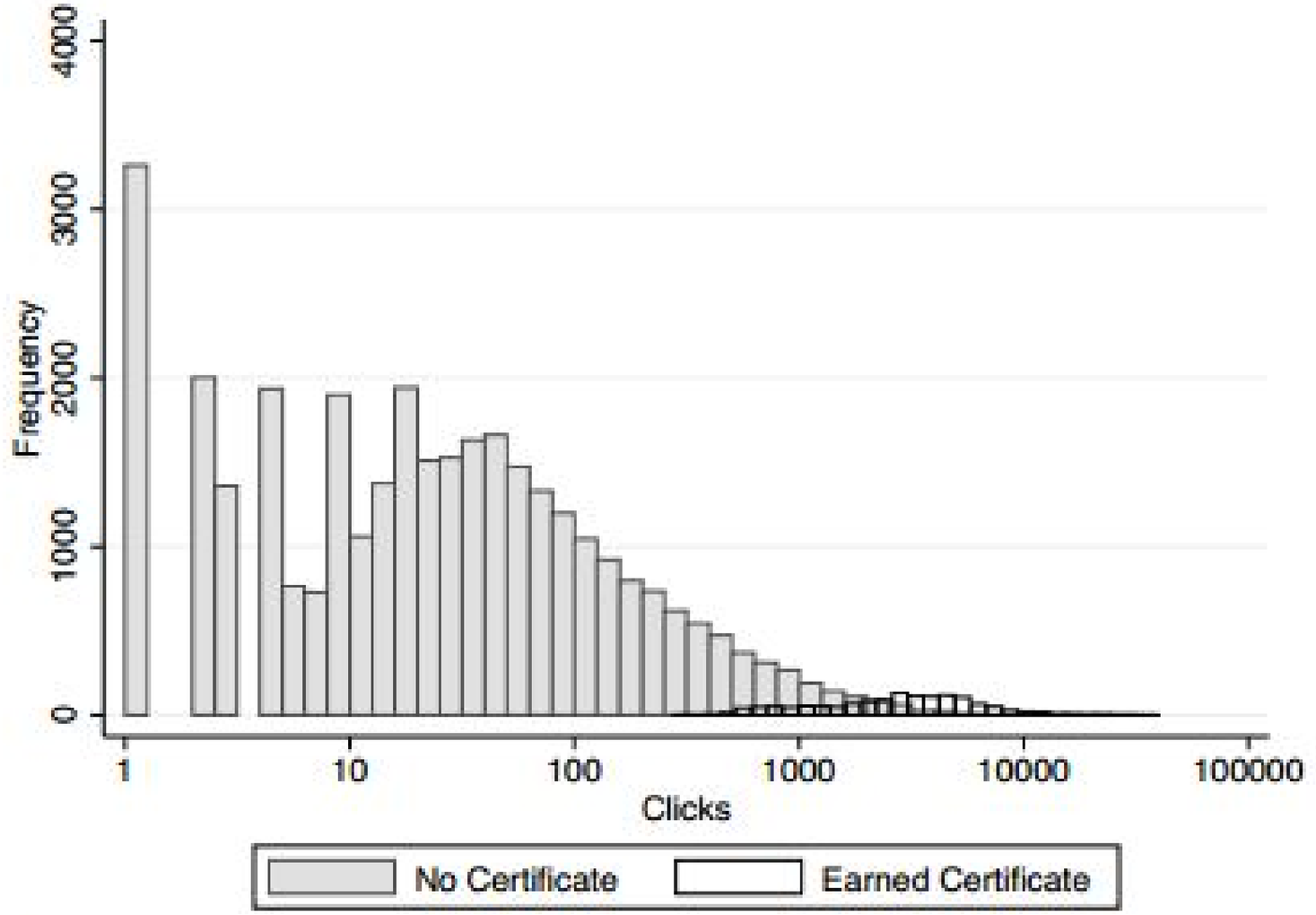


Figure 13: **Number of participant clicks (i.e. recorded actions) plotted on a log scale for Heroes certificate earners (*n*=1,400) and non-certificate earners (*n*=42,163).**

Reich’s Law

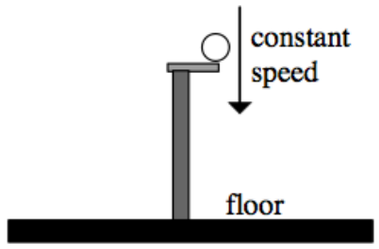
1) Students who do stuff, do more stuff.
2) Students who do stuff,
do better than students who don’t do stuff.

Just make student do more stuf!!!!!

Figure 4-3a. Elevator problem that corresponds to several FCI questions from Steinberg and Sabella, "Performance on multiple-choice diagnostics and complementary exam problems," in *The Physics Teacher*.[47]

Exam problem 1: Ignore all friction and air resistance in this problem.

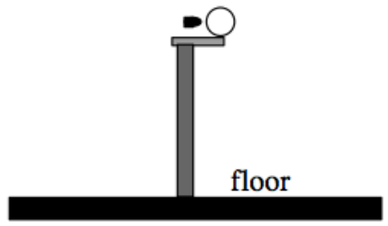
A. A steel ball resting on a small platform mounted to a hydraulic lift is being lowered at a constant speed, as shown in the figure at right.



i. Draw a free body diagram of the ball. Describe each type of force.

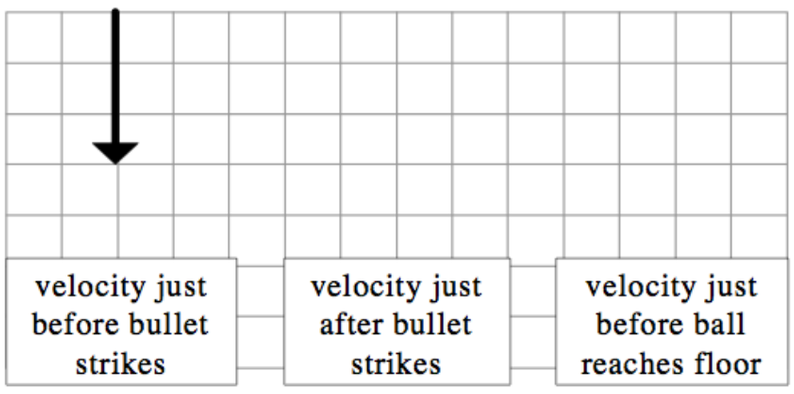
ii. Compare the magnitudes of the forces you have drawn. Explain your reasoning.

B. As the ball is moving down, a bullet moving horizontally hits the exact center of the ball (see figure at right) and then ricochets straight back. This causes the ball to immediately fall off the platform.



i. Draw a free body diagram of the ball after it is no longer in contact with the bullet or the platform. Describe each type of force.

ii. A vector that represents the velocity of the ball just before the bullet hits is shown below. Draw vectors that could represent the velocity at each of the 2 other times indicated. The scales of the 3 vectors should be consistent with each other. Explain your reasoning.



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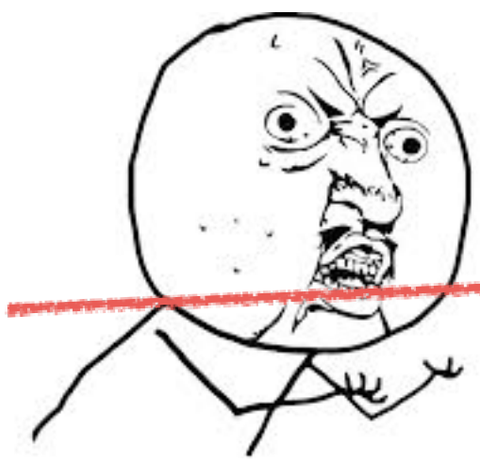

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Measure learning.

Iteratively improve your technologies based on learning data, not participation data

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Design Principles for Measuring Learning in Open Online Education

1) Measure Change in Competency over Time
2) Measure the Most Important Competencies
3) Use Validated Measures of Learning

Computing Readiness Pre-Test

In a counting system used by intelligent apes,

A banana = 1;

6 is represented by an orange and 2 bananas;

An orange is worth half a mango.

What is the value of two mangos, an orange and a banana?

Gerhard Sonnert, Philip Sadler

Harvard-Smithsonian Center for Astrophysics

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```
:( hello.c exists
   \ expected hello.c to exist
:| hello.c compiles
   \ can't check until a frown turns upside down
:| prints "hello, world\n"
   \ can't check until a frown turns upside down
```

```
:) hello.c exists
:) hello.c compiles
:( prints "hello, world\n"
   \ expected output, but not "hello, world"
```

Terminal

File Edit View Terminal Tabs Help

```
jharvard@appliance (~/Desktop/student1): check50 2013.pset5.resize resize.c bmp.h
:) resize.c and bmp.h exist
:) resize.c compiles
:) doesn't resize 1x1-pixel BMP when n is 1
:) resizes 1x1-pixel BMP to 2x2 correctly when n is 2
:) resizes 1x1-pixel BMP to 3x3 correctly when n is 3
:) resizes 1x1-pixel BMP to 4x4 correctly when n is 4
:) resizes 1x1-pixel BMP to 5x5 correctly when n is 5
:) resizes 2x2-pixel BMP to 4x4 correctly when n is 2
https://sandbox.cs50.net/checks/013d312746ee49cf9958d5de4176e39b
jharvard@appliance (~/Desktop/student1):
```

In your answer to this second question, do you see the word mūthos ‘words’ functioning as:

- mūthos - a story made for heroes by the gods
- mūthos - a story that heroes make for themselves
- mūthos - a story that is both made for heroes by the gods and re-made by heroes whenever they tell the story

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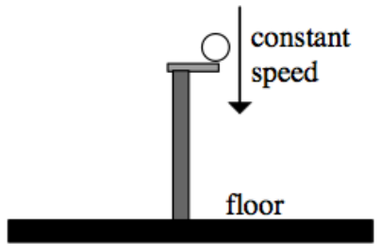

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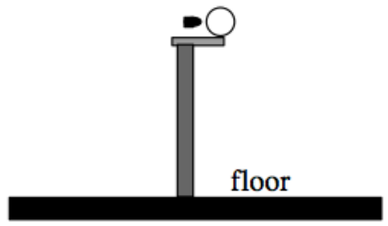

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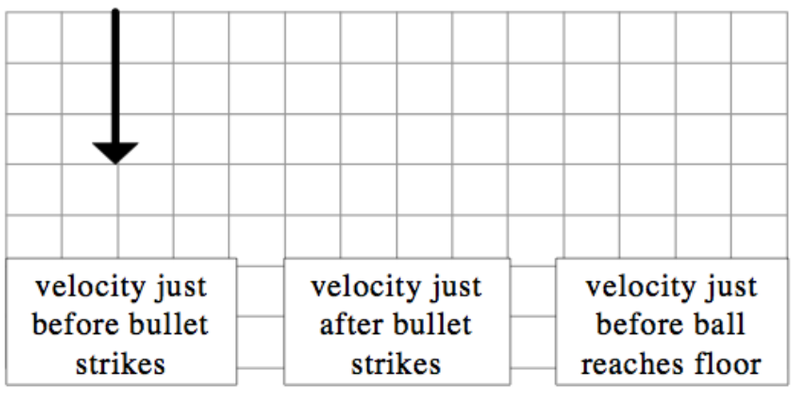

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If you don’t know what your students know,
you can’t make your products better.

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[The State of MOOCs: An EdTech Researcher Retrospective]

[Summarizing all MOOCs on One Slide]
MOOCs as Three Kinds of LMS
[MOOC: Textbook or Course]
[MOOC Killer Apps: Autograder vs. Syndication Engine]
[On our cMOOC inspired site for the Future of Learning Institute]
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[The Learning of a MOOC Dropout]
[Dear Discourse, Let's Start Over, Love MOOCs]
[Picture Pages: The Original Toddler ProtoMOOC]

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