

Carnegie Mellon University



The Open Learning Initiative

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Director, Open Learning Initiative



The New York Times

**College Leaders Meet With Obama
to Discuss Costs and Productivity**

What is Carnegie Mellon's Open Learning Initiative?

Scientifically-based
open online
learning
environments
designed to
improve both
quality and
productivity in
higher education

1. (A \vee B)
2. (A $\rightarrow \neg(C \vee D)$)
3. (B $\rightarrow \neg D$)
4. A
5. D
6. (C \vee D)
7. $\neg(C \vee D)$
8. \perp
9. $\neg D$
10. B

Premise
Premise
Premise
Assumption
vIL: 5
 \rightarrow E: 2,4
 \perp I: 6,7
 \neg I: 8
Assumption

XYdim Chemistry Lab - Default Lab Setup

Stockroom Explorer

- 1M NaClO₂CHCOO
- 1M NaOH
- 1M NaHCO₃
- 1M NaH₂CHCOO
- 1M NaOBr
- 1M NaOCl
- 1M NaOH

Indicators

- Bromocresol Green
- Cresol Red
- Methyl Orange
- Methyl Red
- Phenolphthalein

Stock Solutions

- 11.6M HCl
- 14.6M H₂PO₄
- 14.6M NH₃
- 15.6M HNO₃
- 15M HClO₄
- 17.6M H₂SO₄

Workbench 1

10mL Pipet

1M C₂H₃N₂

1M NaHCO₃

Transfer amount (mL)

from 10mL Pipet to 1M NaHCO₃

Determine the sum of three concurrent forces:

Force F₁ has a magnitude of 9N, its line of action passes through points A (1, 1) and B (4, 3)

Force F₂ has a magnitude of 2N, its line of action is parallel to a 3-4-5 triangle

Force F₃ has a magnitude of 6N, its line of action is at 60 degrees to the horizontal

What is the magnitude of the sum?

R = N

What is the direction of the sum?

$\theta =$ degrees

Hint

Recall:

Step 1: Resolve each force into components:

F_{1x} = N F_{1y} = N

F_{2x} = N F_{2y} = N

F_{3x} = N F_{3y} = N

Step 2: Find the components of the sum by summing components of the forces:

R_x = F_{1x} + N R_y = F_{1y} + N

Step 3: Find the magnitude of the sum: $R = \sqrt{R_x^2 + R_y^2}$

R = N

Step 4: Find the direction of the sum: $\theta = \tan^{-1} \frac{R_y}{R_x}$

$\theta =$ degrees

according to the "role type
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ng Objectives]

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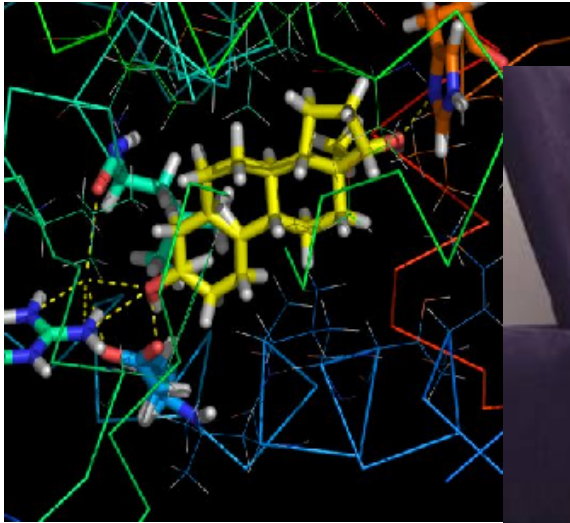
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[Show Sub-Learning Objectives

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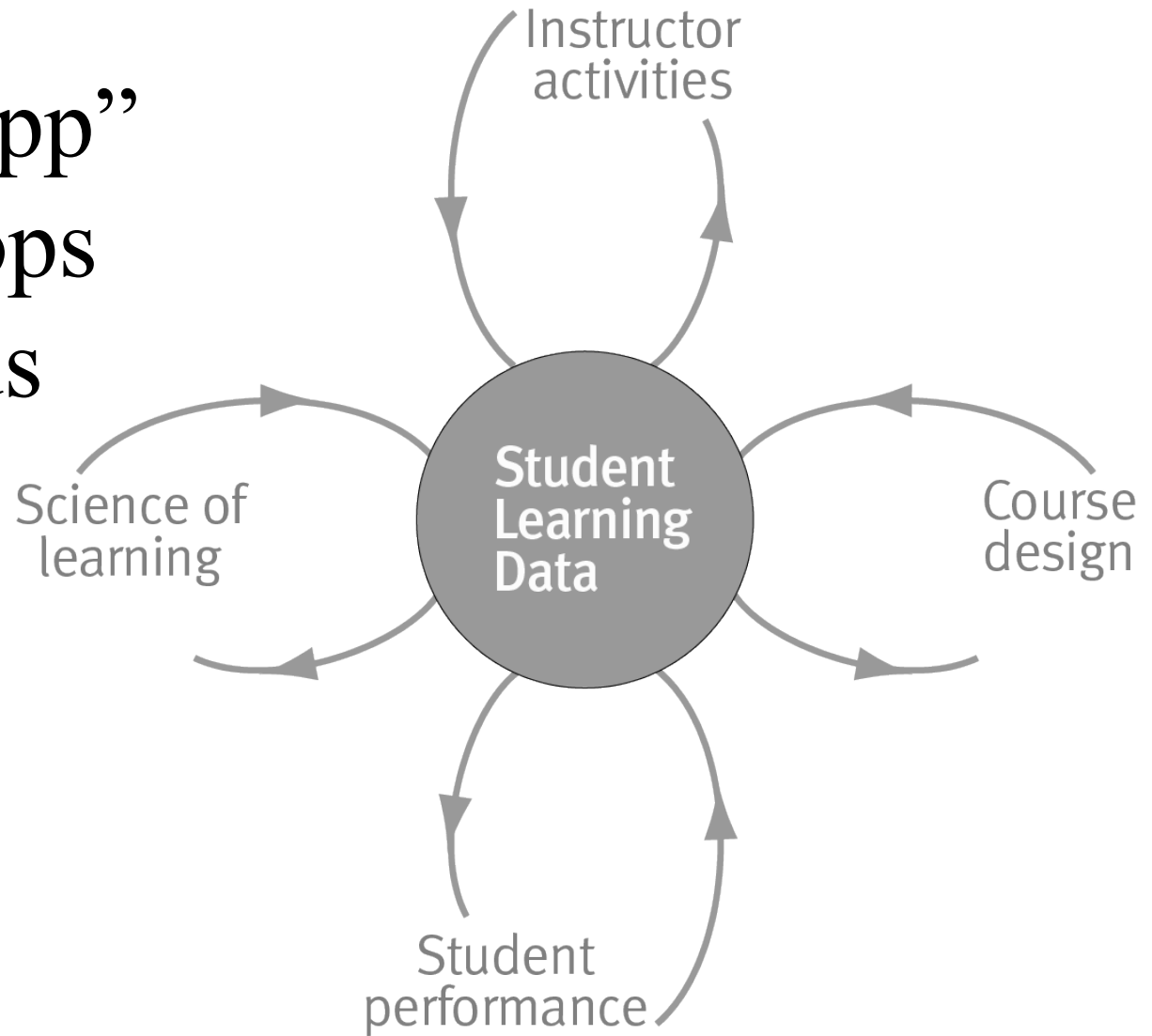
HA \rightleftharpoons A⁻ + H⁺

6 4 4

What Are the Affordances of the Technology?

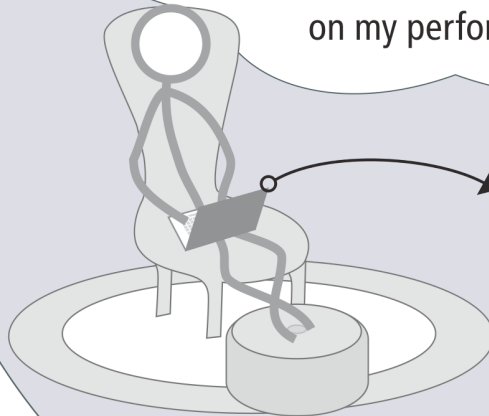


“The Killer App” Feedback Loops for Continuous Improvement



The Student

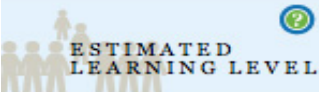
In OLI, I work through the module that includes "Learning Objective A." In the module, I am asked to complete inline assessments. I apply the concepts and skills for "Learning Objective A" to solve problems. I receive immediate feedback on my performance.



The OLI system:

Records interaction-level detail as the student works through the module and provides immediate and targeted feedback to the student.

Examining Distributions



Learning Objectives



Summarize and describe the distribution of a categorical variable in context.

[» Show Details...]



Generate and interpret several different graphical displays of the distribution of a quantitative variable (histogram, stemplot, boxplot).

[» Show Details...]



Summarize and describe the distribution of a quantitative variable in context: a) describe the overall pattern, b) describe striking deviations from the pattern.

[» Show Details...]



Relate measures of center and spread to the shape of the distribution, and choose the appropriate measures in different contexts.

[» Show Details...]



Compare and contrast distributions (of quantitative data) from two or more groups, and produce a brief summary, interpreting your findings in context.

[» Show Details...]



Apply the standard deviation rule to the special case of distributions having the "normal" shape.

[» Show Details...]

Class Participation

39 of 40 students participated

48% of 43 activities started on average

» View Participation in Module by Student

Open-ended Responses

- » One Categorical Variable > Learn By Doing [11]
- » Histogram > Learn By Doing [4]
- » My Response: About Stemplots [9]
- » Measures of Center > Learn By Doing [12]

Show All (14 more)

Checkpoints and Quizzes

- » Checkpoint: Examining Distributions Checkpoint 1 [38]
- » Checkpoint: Examining Distributions Checkpoint 2 [36]



Relate measures of center and spread to the shape of the distribution, and choose the appropriate measures in different contexts.

[» Hide Details...]

Estimated Learning by Student ?

40 students
1 dot = 1 students



Class Accuracy by Sub-Objective ?

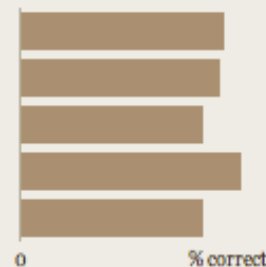
Predicting...

Mean vs median

Compute median

Identify outlier

Select appropriate...



Students with Moderate Estimated Learning X

ACTIVITIES
ATTEMPTED

Bo	7
Ca	8
co	10
Co	8
Ge	9
Ge	8
Go	9
Le	8
Ma	10
Me	8
Ro	9
Ro	9

☐ Contact these students

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Class Parti

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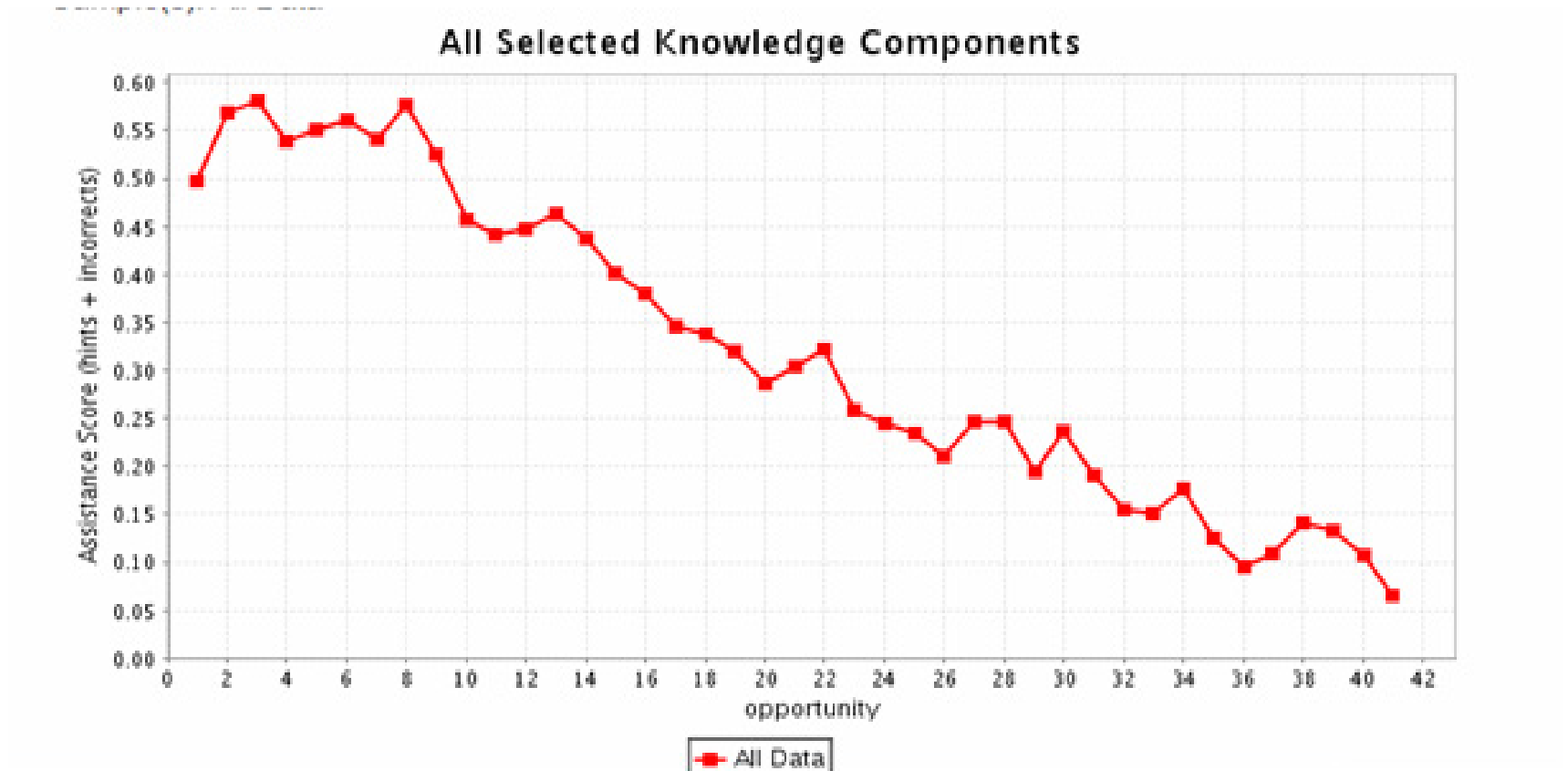
[4]

My Response: About Stemplots [9]

» Checkpoint: Examining Distributions Checkpoint 1 [38]

» Checkpoint: Examining Distributions Checkpoint 2 [36]

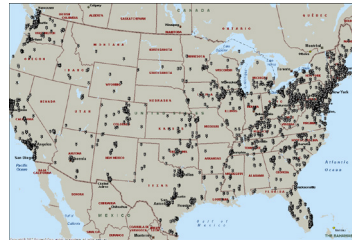
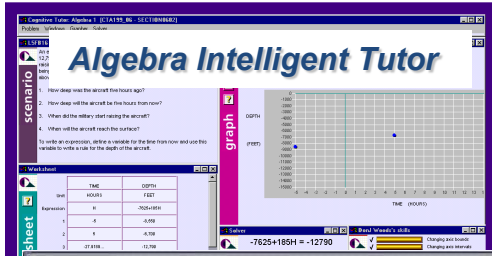
Learning Curve Analysis



DataShop: Pittsburgh Science of Learning Center

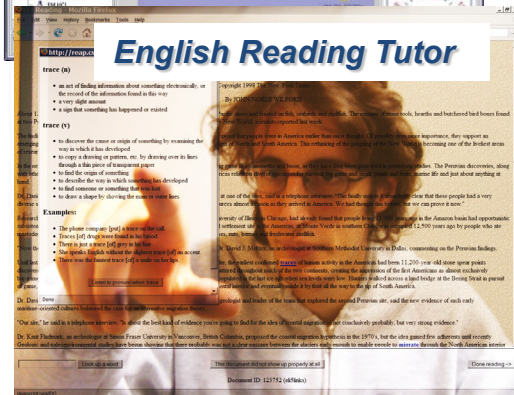
LearnLab: Transforming Education Research

Ed tech + wide use = “Basic research *at scale*”

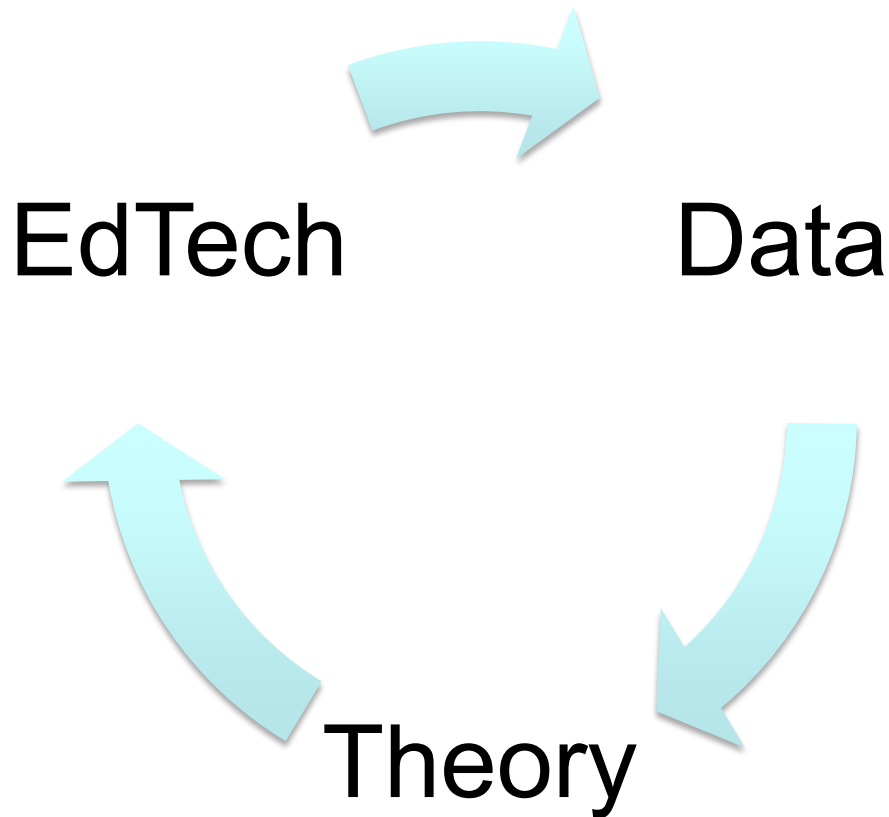


NSF Science of Learning Center

- 10 years, ~\$50 million
- Tech enhanced courses, assessment, & research
- School cooperation for data collection

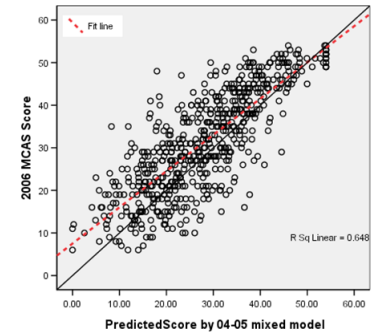
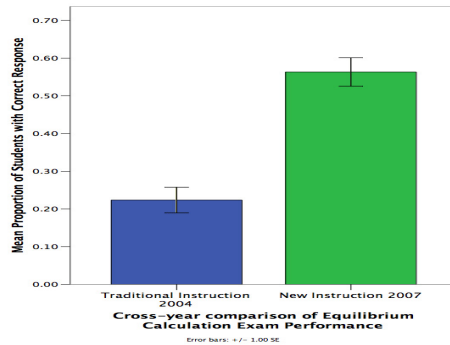


Strategy for Educational Improvement



Better Science & Technology ...

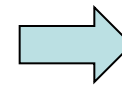
Improves Assessment



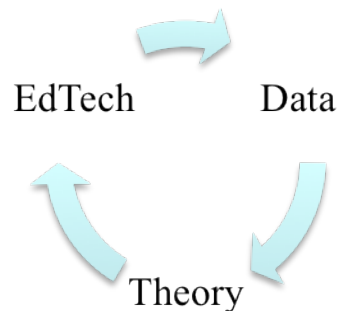
Increases Outcomes &

Accelerates Learning

> 100 hours
~3% learning gain



< 50 hours
~18% learning gain



Produces Virtuous Cycle for Education Improvement

“Improvement in Post Secondary Education will require converting teaching from a ‘solo sport’ to a community based research activity.”

—Herbert Simon

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