

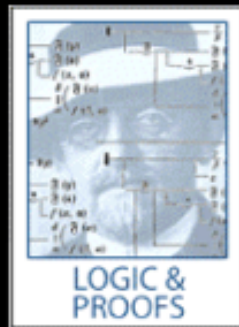
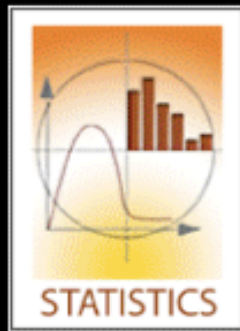
Continuous Improvement in
Learning:
Data from the Open Learning
Initiative

Joel Smith, Vice-Provost & CIO

Candace Thille, Director OLI

The Open Learning Initiative

Created 12 web-based colleges courses which provide the complete enactment of instruction online



The Open Learning Initiative: Principles

- Course design is guided by results from the learning sciences
- Course creation is done by a team rather than a single person
- Virtual learning environments are instrumented to continuously gather data about student learning outcomes
- Rich feedback data is used for continuous improvement

Course Design Guided by Learning Science Principles (LSPs)

- Translating scientific results from the learning sciences into effective instruction requires significant design and assessment efforts
- Such an effort by one faculty member for a single class is exceptional and impacts comparatively few students
- Such efforts made by a team for online virtual learning environments produces effective materials that can be used by many faculty and learners

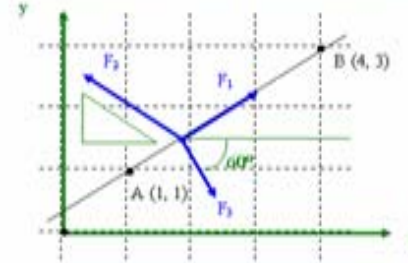
LSP1 - Goal directed feedback and targeted practice enhance learning:

Determine the sum of three concurrent forces:

Force F_1 has a magnitude of 9N , its line of action passes through points $A(1, 1)$ and $B(4, 3)$

Force F_2 has a magnitude of 2N , its line of action is parallel to a 3-4-5 triangle

Force F_3 has a magnitude of 6N , its line of action is at 60° 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:

$R_x = \Sigma F_x =$ N $R_y = \Sigma F_y =$ 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

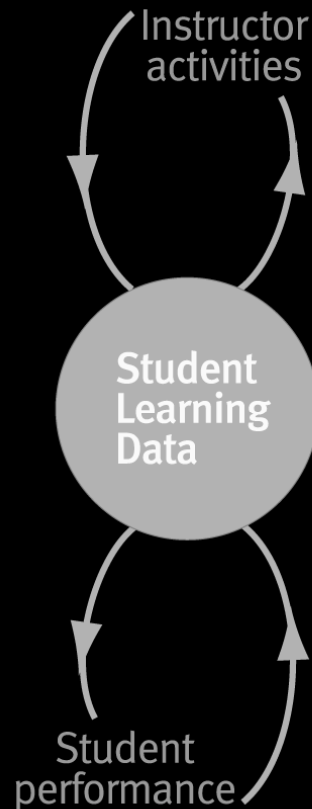
LSP2 -
Meaningful
engagement
creates
robust
learning:

The screenshot displays the IYBian Chemistry Lab software interface. The main window is titled "IYBian Chemistry Lab - Default Lab Setup". The interface is divided into several panels:

- Stockroom Explorer:** A list of chemical reagents and indicators. The "Stock Solutions" section is expanded, showing various concentrations of acids and bases. The selected item is "1M Sodium Hydrogen Carbonate".
- Workbench 1:** A virtual lab environment showing a 10mL Pipette being used to transfer liquid from a 1M NaHCO₃ solution to a 1M C₂H₃NO₂ solution.
- Solution Info:** A panel on the right showing the current solution's name ("1M NaHCO₃"), volume ("100.0 mL"), and state ("Aqueous"). It also includes a bar chart showing the log molarity of various species and a table of species and their molarities.
- Species and Molarity Table:**

Species	Molarity
H ⁺	4.624e-9
OH ⁻	2.163e-6
Na ⁺	1.000e0
HCO ₃ ⁻	9.792e-1
H ₂ CO ₃	1.015e-3
CO ₃ ²⁻	1.015e-3
- Temperature:** A digital display showing "25.0°C".
- pH Indicator:** A circular gauge showing a pH value of "8.3".
- Transfer amount (mL):** A field showing "0.00" with a "Withdraw" button.
- Transfer Info:** A panel showing "from 10mL Pipette" and "to 1M NaHCO₃".

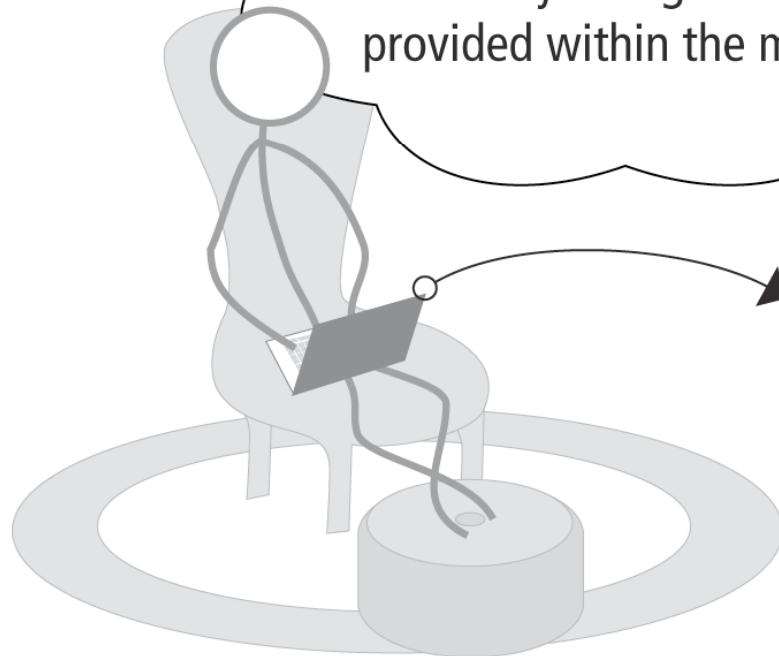
Feedback: Changing the Effectiveness of both Learners and Faculty



Student homework for "Concept A"



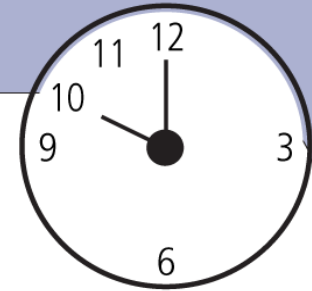
In OLI, read Module 1 which covers "Concept A." Do the "Learn By Doing" exercises provided within the module.



OLI records student's responses to the "Learn By Doing" exercises.

Digital Dashboard displays student performance.

Instructor prepares for class

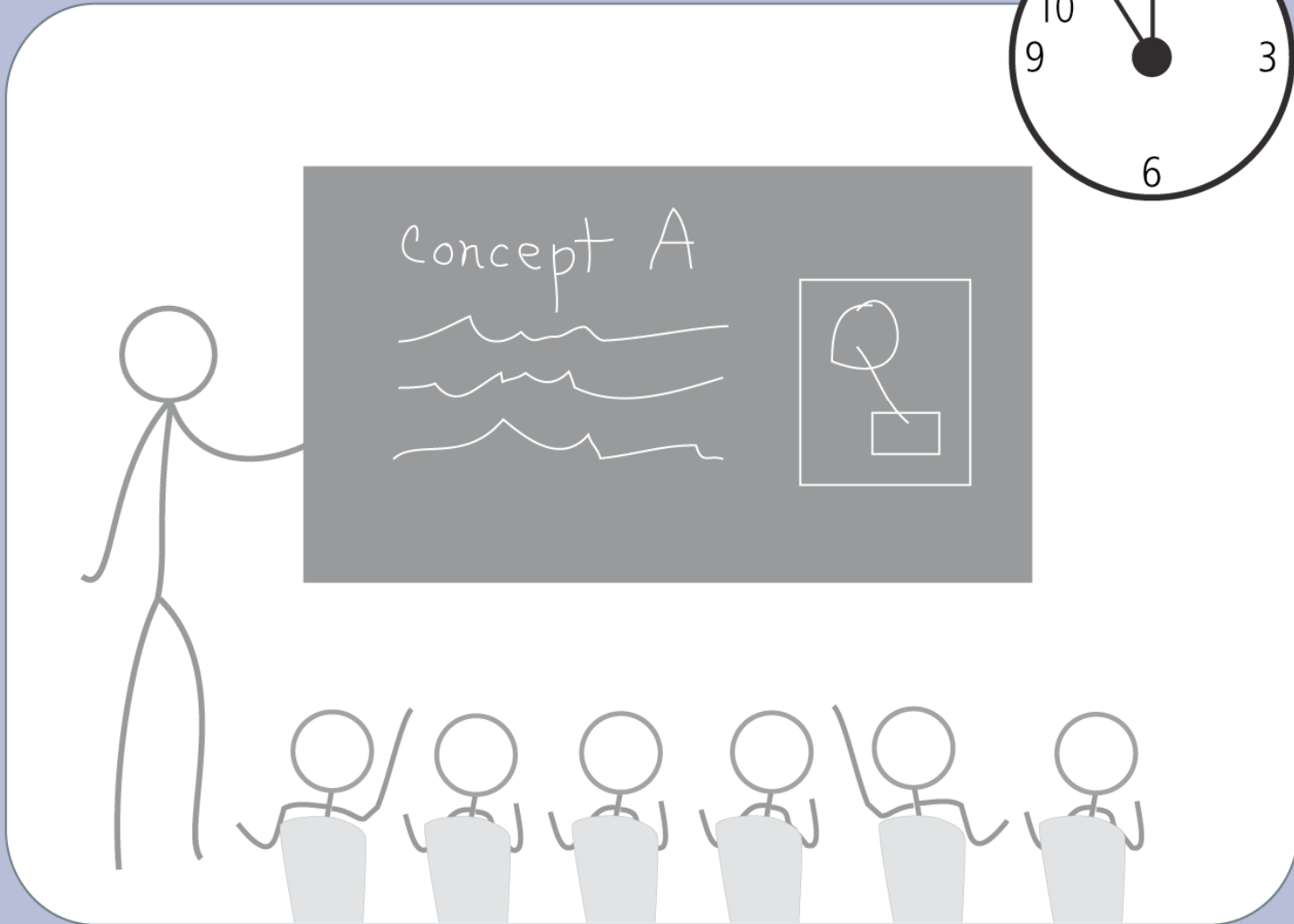
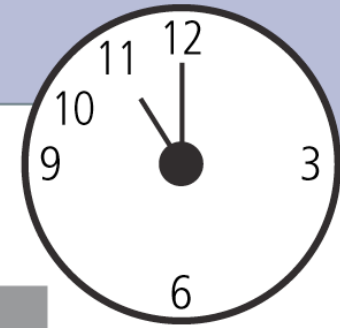


Prepare lecture notes to review "Concept A." Prepare questions to test student understanding of "Concept A."



Digital Dashboard shows that students performed poorly on "Learn By Doing" exercises on "Concept A."

In-class instruction on "Concept A"



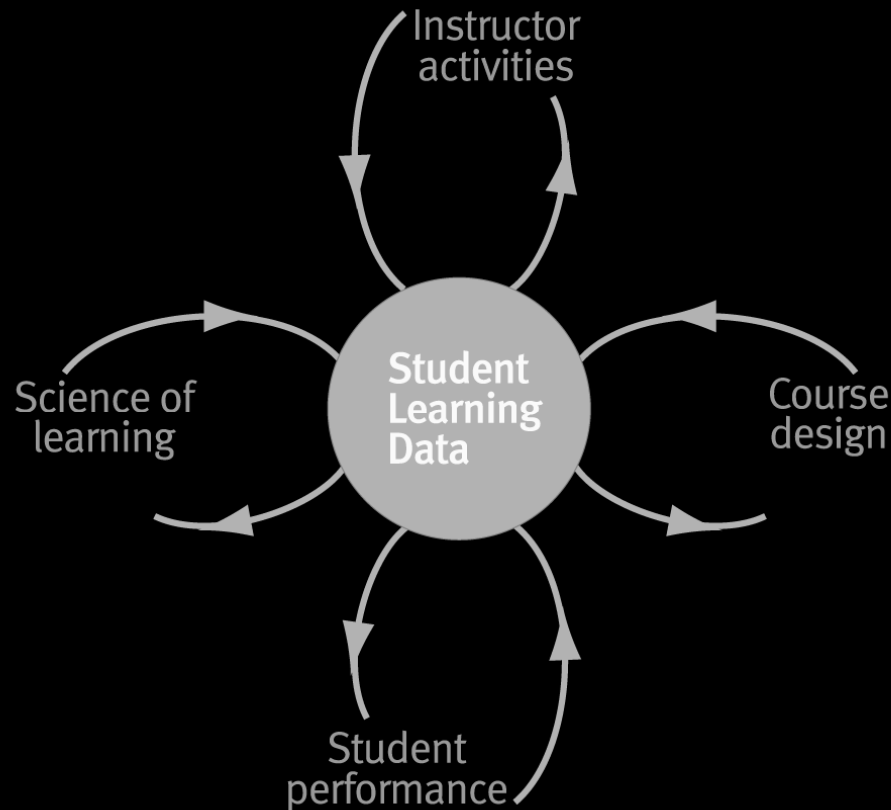
Accelerated Learning Results

- OLI students completed course in half a semester, meeting half as often during that time
- OLI students showed significantly greater learning gains (on the national standard “CAOS” test for statistics knowledge)
- No significant difference between OLI and traditional students in follow-up measures of knowledge retention given a semester later
- These results on improvement on CAOS test have now been replicated with a much larger sample

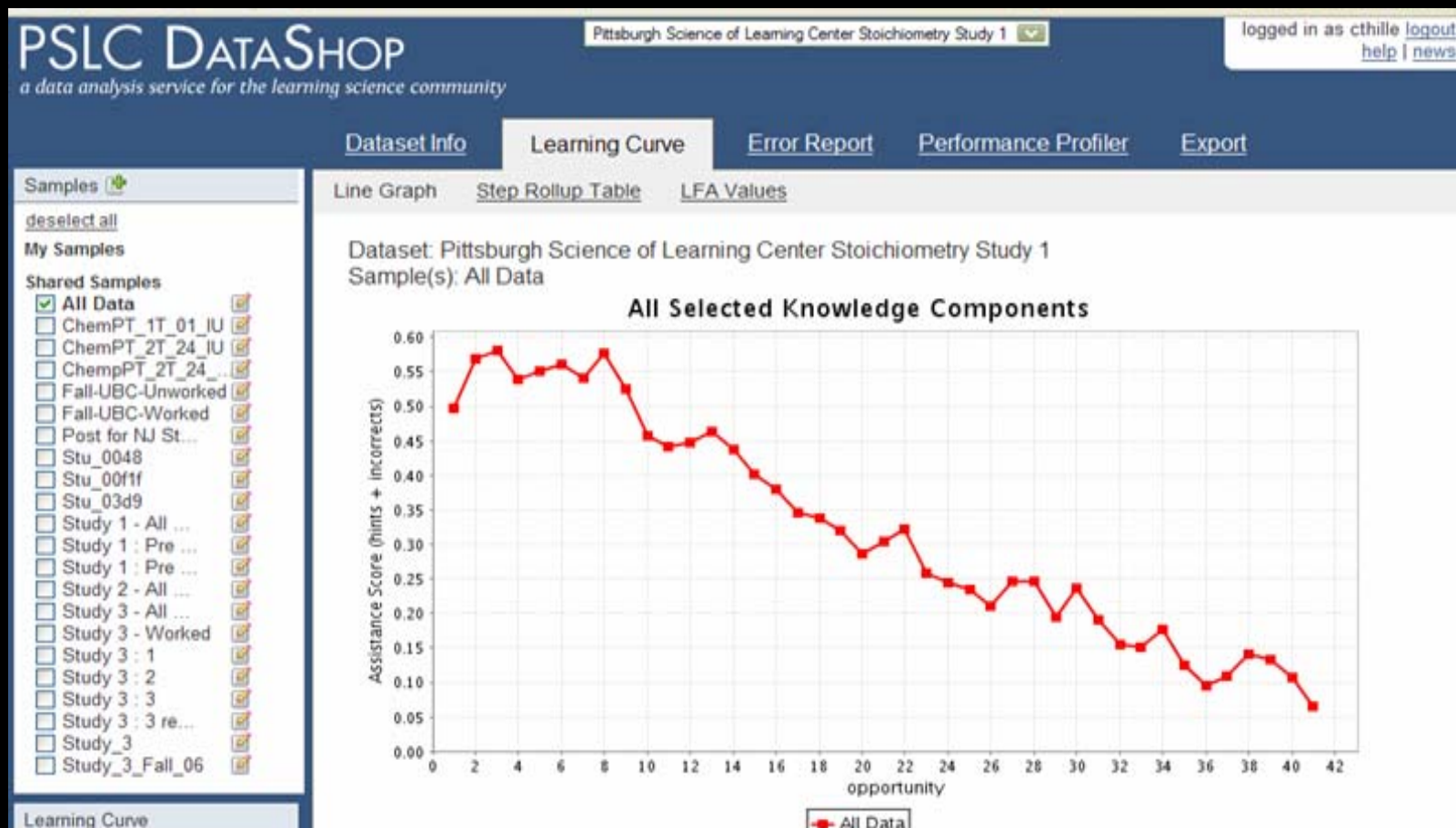
Other Class Results

- Community College accelerated learning study in Statistics
 - OLI: 33% more content covered
 - OLI: 13% learning gain vs. 2% in traditional face-to-face class
- Large State University:
 - OLI: 99% completion rate
 - Traditional face-to-face class: 41% completion rate

Design and Feedback: Continuous Improvement



Learning Curve Analysis on Chemistry Course Data



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

—Herbert Simon

www.cmu.edu/oli

joelms@cmu.edu

cthille@cmu.edu