METALS

Masters of Educational Technology & Applied Learning Science

Learn. Create. Innovate.

Virtual Open House

October 17 @ 11 AM EDT

Applications Due December 14th

http://metals.hcii.cmu.edu

Welcome!

- Ken Koedinger, Director
- Michael Bett, Managing Director

Extended Welcome from Our Learning Science Faculty


Vincent Aleven


Justine Cassell


Sharon Carver


Ken Koedinger


Jessica Hammer

Chinmay Kulkarni 

Marti Louw 

Bruce McLaren 

Amy Ogan 

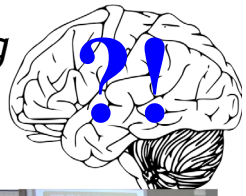
Carolyn Rose 

John Stamper 

+ many others outside of

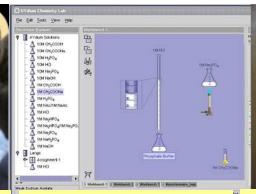
Science & technology of learning: important, interesting, challenging!!

- Education is *important*
- Unlocking the mysteries of human learning is *interesting*
- Tech innovation is *challenging, fun, powerful*




Intelligent tutors helping city kids catch up in math


Learning games on mobiles in Africa


Virtual labs & MOOCs scaling education


Intelligent exhibits make doing science fun!

A bit about me, Ken Koedinger

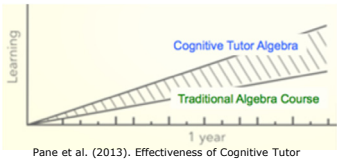
- Modest educational background
  - Tech skills, want to make a difference
- Math ugrad, computer science masters, cognitive psychology phd => HCI
- Intelligent tutors for math
  - In city schools
  - Spin-off reaches millions
  - Doubles algebra achievement
- Direct LearnLab, formed METALS

Overview

- **CMU & METALS are unique**
- Curriculum
  - Capstone
  - Courses
- Finances

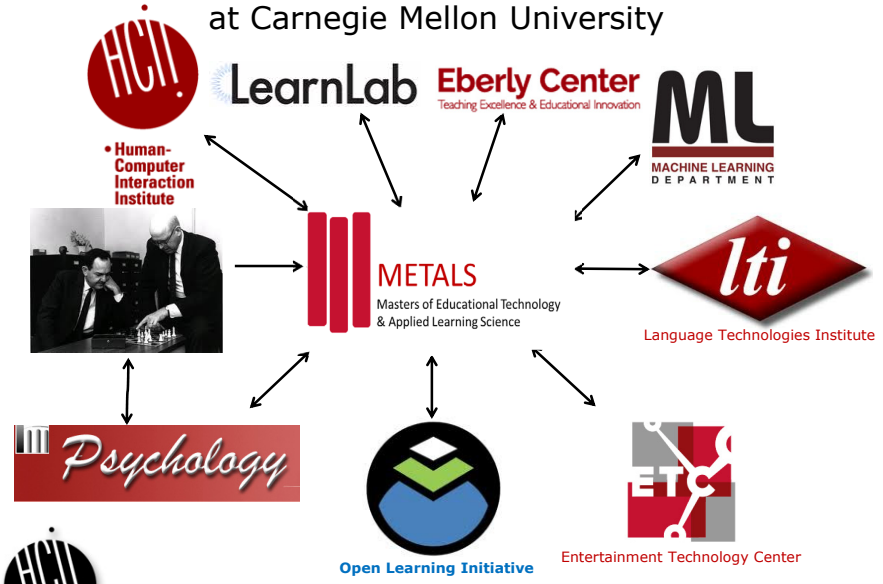
CMU Learning Science is Making a Difference

- Real-world impact of Cognitive Tutors
  - 600K students/year
  - *Doubles achievement!*
  - 2011 sale for ~$95M
- OLI college courses
  - 25 open online courses
  - *2x faster & better*



Pane et al. (2013). Effectiveness of Cognitive Tutor Algebra I at Scale. RAND.

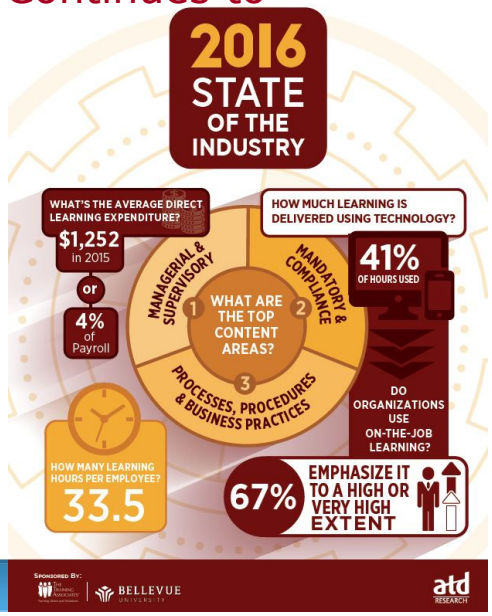
Learning Science & Technology Ecosystem at Carnegie Mellon University



Learning & Training Continues to Boom!!

- *New ideas*
- *New technologies*
- *New companies*
- *New careers*

Report on industry trends
https://www.td.org/Professional-Resources/State-Of-The-Industry-Report



The Ed Tech Market is Huge!

World market: $1.3 Trillion*
740M Students*
US K12 Market: $8.56B**

*https://prezi.com/xguky7u7aur6/ed-tech-market-map/
**http://www.simbainformation.com/Publishing-PreK-9618089/

Many Spinoffs and Local Companies

CARNEGIE LEARNING
acrobatiq powered by CARNEGIE MELLON
DDI
duolingo
NoRILLA Novel Research-based Intelligent Lifelong Learning Apparatus
turnitin
BloomBoard
h{sll
SCHELL GAMES
TTM Think Through Math

Many Corporate Partners

WGU Western Governors University www.wgu.edu
CARNEY
KAPLAN
RENAISSANCE
PEARSON
BloomBoard
McGraw Hill Education
DDI
turnitin
CARNEGIE LEARNING

Carnegie Mellon is Unique

Our Values… Innovative, Inspiring, Influential, Quality, Interdisciplinary, Business, Relevant, Impactful

Our Methods… cutting edge, grounded in theory, drawn from industry

Our Research…collaborative

Our Projects… practical and experiential

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Major Focus: Capstone Project

- Apply METALS skills on a two semester-long project
- Work in interdisciplinary teams (4-6 people)
- Work with clients
- Integrate skills gathered over the curriculum
- Learn to write reports & give presentations

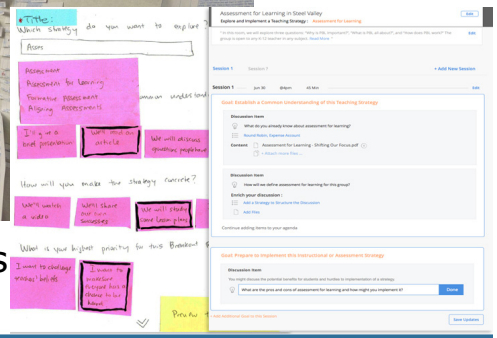
Learn to Create Evidence-Based Innovations in Learning

Gather Field Data

Review Literature

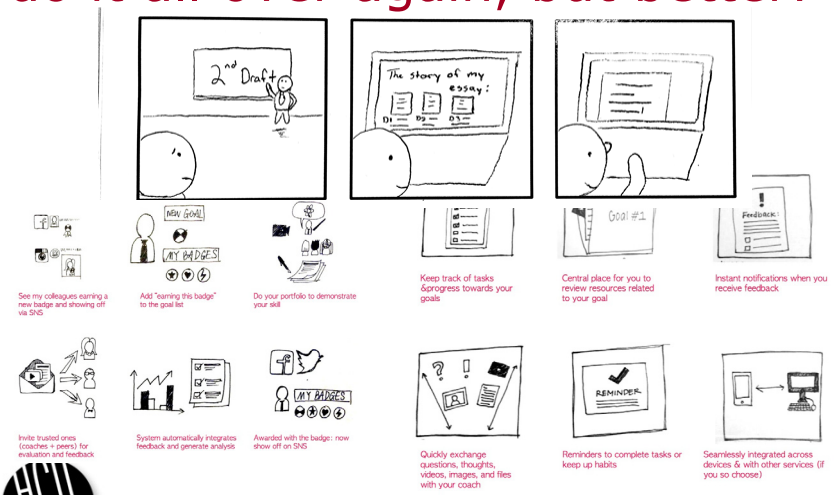
Understand Needs

Understand Research



Create Effective Designs

…And design some more. Then do it all over again, but better!



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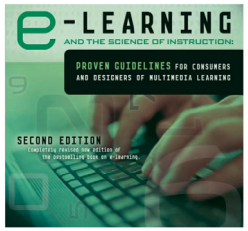
METALS Core Courses

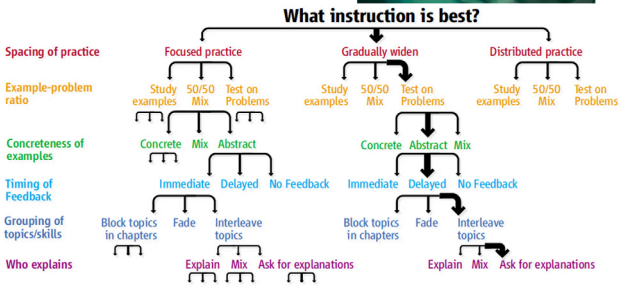
- **E-Learning Design Principles & Methods**
- **Educational Goals, Instruction and Assessment**
- **Interaction Design Overview**
- **Tools for Online Learning**
- **Capstone Project**

E-Learning Design Principles & Methods

- Gain a *broad understanding* of the field and literature.
- Know when to apply *evidence & theory*
- Learn how to adapt *methods* to specific needs

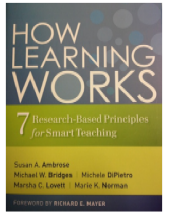


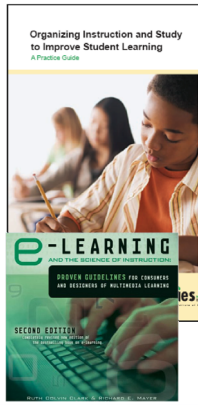
Ken Koedinger
TA: Mimi McLaughlin



Understand the best form of instruction

- More assistance vs. more challenge
  - Basics vs. understanding
  - Education wars in reading, math, science…
- Researchers like binary oppositions too. We just produce a lot more of them!
  - Massed vs. ***distributed*** (Pashler)
  - Study vs. ***test*** (Roediger)
  - ***Examples*** vs. problem solving (Sweller …)
  - ***Direct instruction*** vs. discovery learning (Klahr)
  - Re-explain vs. ***ask for explanation*** (Chi, Renkl)
  - ***Immediate*** vs. ***delayed*** (Anderson vs. Bjork)
  - ***Concrete*** vs. ***abstract*** (Pavio vs. Kaminski)
  - …

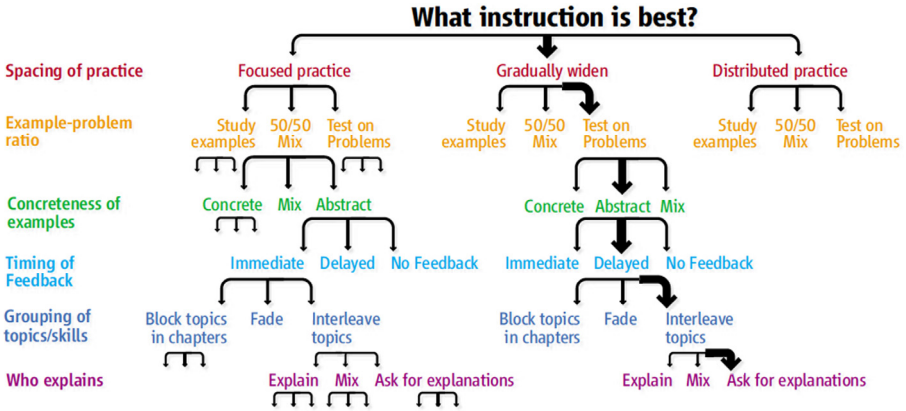




Koedinger, K. R., & Aleven, V. (2007). Exploring the assistance dilemma in experiments with cognitive tutors. *Educational Psychology Review, 19*(3), 239-264.

Instructional Complexity
How many instructional options are there?

More help, *passive* ⟷ More challenge, *active*



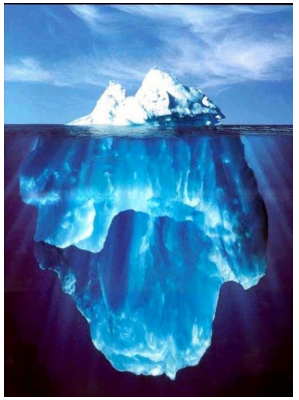
Many other dimensions of choice: animations vs. diagrams vs. not, audio vs. text vs. both, …

>3^{15*2} = 205 trillion options!

Koedinger, Booth, Klahr (2013). Instructional Complexity and the Science to Constrain It. *Science*.

What instructional choices are best for a particular course?

- Choices depend on a deep understanding of the content
  - A "cognitive model"
- But, do course designers know what they know?



Creating Cognitive Models is not Obvious

Which is hardest for algebra students?

Story Problem

As a waiter, Ted gets $6 per hour. One night he made $66 in tips and earned a total of $81.90. How many hours did Ted work?

Word Problem

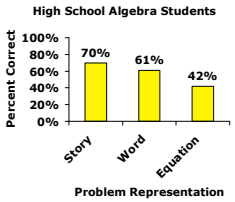
Starting with some number, if I multiply it by 6 and then add 66, I get 81.90. What number did I start with?

Equation

x * 6 + 66 = 81.90

Math educators say: story or word is hardest

Equations are hardest for students…



Expert blind spot!

Experts do not know what they know: They are incorrectly think equations are easy for students

Learning Objectives

What to do

- Design Principles
  - Multimedia instruction
  - Learning by doing
  - Supporting metacognitive, motivation & dispositions

When & how to do it

- Design Methods
  - Cognitive Task Analysis
  - Assessment design
  - User experience
  - A/B testing

What tools/technology to use

How to analyze and improve instruction

Example Elective Courses

Technology

Personalized Online Learning
Design of Educational Games
Applied Machine Learning
Computational Models of Discourse Analysis
Design & Engineering of Intelligent Information Systems
Role of Technology in Learning in the 21st Century
The Big Data Pipeline
Mobile Service Innovation

Psychology

Cognitive Development
Human Expertise
Applications of Cognitive Science
Research Methods for the Learning Sciences
Role of Technology in Learning in the 21st Century
Scientific Research in Education
Learning Analytics and Educational Data Science

UX Design

Human Factors
Stats: Experimental Design for Behavioral and Social Sciences
Design of Educational Games
Service Design Social Perspectives in HCI
Computer Science Perspectives In HCI
Research Methods in Human Centered Design
Learning Media Design
Learner Experience Design

General Electives Continued

- Crowd Programming
- Entrepreneurship
- Designing for Service
- Web Accessibility
- Gadgets, Sensors and Activity Recognition in HCI
- Machine Learning Text Mining
- Advanced Web Design
- Designing Human Centered Software
- Social Perspectives in HCI
- Language and Statistics
- Decision Making Under Uncertainty

- >100 others in other part of the university, if approved
  - Business, CFA, H&SS, CS, Robotics, Entertainment Technologies

We want students who are:

- Passionate about using technology to develop better learning outcomes
- With backgrounds especially in
  - computer science
  - design
  - psychology
  - education
  - business
  - any educational content domain

On the Philosophy…

- METALS education provides students
  - Skills to engineer & implement innovative & effective educational solutions
  - Real-world project-based experience
  - Team management
- You will learn about all of software development, psychology, & design
  - You will not become an expert in all in 1 year
  - You will learn to communicate with specialists in other areas

What You Will Be Able to Do After METALS? Part 1

- Design, develop, & implement *innovative, effective, & desirable* educational solutions
- *Innovative*
  - Use state-of-the-art technologies

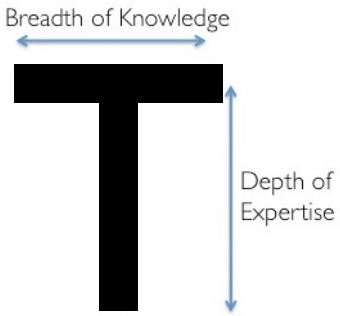
    AI, machine learning, language technologies, intelligent tutoring systems, mixed reality, …
- *Effective*
  - Apply cognitive & social psychology principles to instructional design, analysis, & redesign
  - Design & evaluate using cognitive task analysis, data mining, statistics, experimentation

What You Will Be Able to Do After METALS? Part 2

- *Desirable*
  - Design skills to enhance learning *and* enjoyment
- *Innovative*: Analytic, psychometric & educational data mining skills
- *Putting it together*: Develop continual improvement programs that employ experiments & analytics to reliably identify best practices & opportunities for change

Gain Breadth & Expertise

- You may already possess expertise in some of these areas, but not in all.
- METALS will
  - Deepen your prior expertise
  - Broaden your knowledge new areas



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Finances

- 2017-2018
  - 3 Semesters
  - $21,500 per semester
  - $21,000 for living expenses
  - $85,500 commitment
- 2017-2018 Tuition Not Set
- Currently exploring offering merit-based tuition assistance
  - If you are skilled & passionate,
  - let us know!

Application Guidelines

- Apply Online
  - https://applygrad.cs.cmu.edu/apply/index.php?domain=1
- Applications Due December 14th
- Applications Must Demonstrate
  - Your interest in EdTech
  - Past relevant experience/training
  - Plans after you graduate
- GREs
  - Expected 165 Quantitative, 160 Verbal
  - But we look at the entire application…
- TOEFL
  - 25 or better in 3 out of 4 sections and
  - 23 or better in speaking

Questions?

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