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  Chinmay Kulkarni
Justine Cassell  Marti Louw
Sharon Carver  Bruce McLaren
Ken Koedinger  Amy Ogan
Jessica Hammer  Carolyn Rose
John Stamper

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

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

+ many others outside of

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

**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

**Overview**

- **CMU & METALS are unique**
- **Curriculum**
  - Capstone
  - Courses
- **Finances**
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/xguky7a7zut6/ed-tech-market-map/
**http://www.simbainformation.com/Publishing-PreK-9613899/

Many Spinoffs and Local Companies

Many Corporate Partners
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

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

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.

What instruction is best?

More help, passive

More challenge, active

Instructional Complexity
How many instructional options are there?

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

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)


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**

\[ x \times 6 + 66 = 81.90 \]

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

**High School Algebra Students**

<table>
<thead>
<tr>
<th>Problem Representation</th>
<th>Story</th>
<th>Word</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Correct</td>
<td>70%</td>
<td>61%</td>
<td>42%</td>
</tr>
</tbody>
</table>

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 in 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
- 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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