Virtual Open House
October 14 @ 10 AM EDT
Applications Due December 9th
http://metals.hcii.cmu.edu

Welcome!

- Ken Koedinger, Director
- Michael Bett, Managing Director
- Jo Bodnar, Program Administrator

Extended Welcome from Our Learning Science Faculty

Overview

- CMU & METALS are unique
- Curriculum
  - Capstone
  - Courses
- Finances
- Application
Why Carnegie Mellon

- Where Learning Science began
- Alan Newell and Herb Simon – Turing Prize Winners
- Created Logic Theorist - first thinking machine
- Created the fields of
  - AI
  - Cognitive Psychology
  - Learning Science
  - EDM – Educational Data Mining

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
  - 30+ open online courses
  - 2x faster & better

Learning Science & Technology Ecosystem at Carnegie Mellon University

- LearnLab
- Eberly Center
- ML
- METALS
- lti
- Language Technologies Institute
- Psychology
- Open Learning Initiative
- Entertainment Technology Center
- CARNegie LEARNING
  - Learning Council
  - remake learning
  - acrobatiq

Many Spinoffs and Local Startups

- TutorGen, Inc.
- h{sl}
- Schell Games
- BloomBoard
- Nori
- XLA
- Turnitin
Learning & Training Continues to Boom!!

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

The Education Market is Huge!

- 1.5 Billion K12 Students**
- 151 Million Post-Secondary Students**
- Education World market: $6 Trillion*
- EdTech World Market $227 Billion projected to grow to $404B by 2025*
- Venture Capital: $8.2 Billion*

*https://www.holoniq.com/edtech/10-charts-that-explain-the-global-education-technology-market/
EdTech Investment Remains High

![Graph showing EdTech investment from 2010 to 2020 in billions, with China leading, followed by the USA.](image)

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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

![Graph showing Venture Capital Growth from 2010 to 2020, with China leading, followed by the USA and EU+UK.](image)
Major Focus: Capstone Project

- Apply & integrate METALS skills on a two-semester-long project
- Be a member of an interdisciplinary team (4-6 people)
- For an external client
- Learn to interview (CTA), research, write reports & give presentations
- Produce a high-fidelity prototype

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)
  - ...
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

Educational Goals, Instruction, and Assessment

Students will learn to use scientifically-based principles & practical strategies for:
- developing learner models & educational goals based on analysis of the knowledge, skills, and dispositions required for understanding and mastery
- aligning the instructional program and its valid assessment with learners and goals
- considering additional aspects of learning environments that may impact implementation and evaluation
Course Project

Actually Apply Course Big Ideas
1. Context & Initial Resources
2. Anticipated Learner Profile
3. Learning Goal Specification
4. Assessment Design
5. Instructional Design
6. Research Design

Final Presentation & Poster
Poster Session

Tools For Online Learning

• This course is expected to give you
  – an overview of current educational technology.
  – hands on experience with educational technology used in online learning
• Hands on projects every couple of weeks
• Final project build out a complete course module

Topics Include

• Overview of Educational Technology
• Learning Management Systems
• Accessibility
• Adaptive Learning
• Conversational Agents
• Data-Driven Design and Development
• Online Courseware

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

Learning Science
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

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 a wide variety of backgrounds including:
  - computer science
  - design
  - psychology
  - education

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

• 2021-2022
  – 3 Semesters (4 semester option available)
  – $23,855 per semester
  – ~$27,000 for living expenses
  – $100,000 commitment (for 3 semester option)
• 2022-2023 Tuition Not Set
• Currently offering small merit-based tuition assistance ($1000 - $5000/semester)
  – Not guaranteed
  – If you are skilled & passionate, let us know!
• Scholarships – see METALS FAQ page
  – BiPOC and BLM scholarships (GEM) information
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Application Guidelines

• Apply Online
• Applications Due December 9th
• Applications Must Demonstrate
  – Your interest in EdTech and/or Learning Science
  – Past relevant experience/training
  – Plans after you graduate
• GRE optional but strongly encouraged/preferred
  – Expected 165 Quantitative, 160 Verbal
  – But we look at the entire application...
• English Proficiency is required!
  – TOEFL
    • 25 or better in 3 out of 4 sections and
    • 23 or better in speaking
  – DuoLingo English Test is an option
  – IELTS

Questions?

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