Learn. Create. Innovate.

Virtual Open House

October 12 @ 10 AM EDT
Applications Due December 12th
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

Many Spinoffs and Local Startups
Many Corporate Partners

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/

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• Incredible Opportunities
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Carnegie Mellon is Unique

**Our Values...**
Innovative
Inspiring
Influential
Quality

**Our Methods...**
cutting edge,
grounded in theory,
drawn from industry

**Our Research...**
collaborative

**Our Projects...**
practical and experiential
Major Focus: Capstone Project

- Apply & integrate METALS skills on a two-semester-long project
- Be a member of an interdisciplinary teams (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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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

Paulo Carvalho

What instruction is best?

Human-Computer Interaction Institute

METALS Core Courses

- E-Learning Design Principles & Methods
- Evidence-Based Educational Design
- Interaction Design Overview
- Tools for Online Learning
- Capstone Project

Human-Computer Interaction Institute

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)

**Instructional Complexity**

How many instructional options are there?

**What instruction is best?**

- **Spacing of practice**
  - Focused practice
  - Gradually widen
  - Distributed practice

- **Example-problem ratio**
  - Study examples
  - Test on Problems
  - Mix

- **Concreteness of examples**
  - Concrete
  - Abstract
  - Mix

- **Timing of Feedback**
  - Immediate
  - Delayed
  - No Feedback

- **Grouping of topics/skills**
  - Block topics in chapters
  - Interleave topics

- **Who explains**
  - Explain
  - Mix
  - Ask for explanations

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

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

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**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?**

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**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**
  - $x \times 6 + 66 = 81.90$

**Evidence Based Educational Design**

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

**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
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
  - business

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

- 2022-2023
  - 3 Semesters (4 semester option available)
  - $24,900 per semester
  - ~$27,000 for living expenses
  - ~$100,000 commitment (for 3 semester option)
- 2023-2024 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 12th at 3PM EST
• 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
    • 24 or better in speaking
  – DuoLingo English Test is an option
  – IELTS

Questions?

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