Learn. Create. Innovate.

Virtual Open House

October 10 @ 10 AM EDT
Applications Due December 13th

http://metals.hcii.cmu.edu
Welcome!

• Ken Koedinger, Director

• Michael Bett, Managing Director

• Jo Bodnar, Program Administrator
Extended Welcome from Our Learning Science Faculty

Vincent Aleven  Paulo Carvalho  Sharon Carver  Jessica Hammer  Erik Harpstead  Lauren Herckis  Ken Holstein  Ken Koedinger

Marti Louw  Marsha Lovett  Bruce McLaren  Steven Moore  Amy Ogan  Carolyn Rose  John Stamper  Nesra Yannier
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

Pane et al. (2013). Effectiveness of Cognitive Tutor Algebra I at Scale. RAND.
Learning Science & Technology Ecosystem at Carnegie Mellon University

- Human-Computer Interaction Institute
- LearnLab
- Eberly Center: Teaching Excellence & Educational Innovation
- Machine Learning Department
- Language Technologies Institute
- Psychology
- METALS: Masters of Educational Technology & Applied Learning Science
- Open Learning Initiative
- Entertainment Technology Center
Many Spinoffs and Local Startups
Many Corporate Partners

- Renaissance Learning
- Cengage Learning
- Edmentum
- Microsoft
- Houghton Mifflin Harcourt
- K-12
- Kaplan
- McGraw Hill
- Education
- Turnitin
- Pearson
- Carnegie Learning
- BloomBoard
- Human-Computer Interaction Institute
Learning & Training Continues to Boom!!

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

Spending by area

Edtech Market Projected to triple

Source: www.grandviewresearch.com

Global Decade of EdTech VC

Global Education Venture Capital Funding by Year, 2010-2019 in USD Billions

Source: HolonIQ, January 2020
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
EdTech Investment Remains High

$36.8B of Global EdTech VC

Global Education Venture Capital Funding, 2010-1H2020 in USD Billions

- China: 19.0B
- USA: 11.5B
- India: 2.6B
- Europe: 1.9B
- RoW: 1.8B

Source: HolonIQ, July 2020. All numbers rounded.
Venture Capital Growth

$48B of Global EdTech Venture Capital since 2010

China

United States

India

EU + UK

Source: HolonIQ, 4 January 2021. All numbers rounded and may not sum exactly due to rounding.
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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

Professional Learning Community
- 6 articles
- mutual support
- flexibility
- motives

Professional Development
- 6 articles
- content-focused
- structure
- facilitation

Online Community
- 1 book, 1 article
- contributions
- commitment
- newcomers
- behaviors

Computer Supported Collaborative Learning
- 8 articles
- motivation
- scripts
- social network

Research and Design Methods
- 3 books, 2 articles
- contextual design
- experimental design
- human-centered design

Education Policy
- 2 articles
- standards
- evaluation

Behavioural Change
- 1 book, 1 article, 3 videos
- ability
- trigger
- motivation
- simplicity cycles
- interpersonal trust
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
- Evidence-Based Educational Design (EdDesign)
- Interaction Design Fundamentals
- 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.

Paulo Carvalho
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?

More help, passive

More challenge, active

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

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

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.
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
Reading, and Seminar Discussion
Figuring Out How this All Works...
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

Career Exploration

EGIA Fall 2016

Human-Computer Interaction Institute
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

• 2023-2024
  – 3 Semesters (4 semester option available)
  – $24,900 per semester
  – ~$27,000 for living expenses
  – ~$100,000 commitment (for 3 semester option)
• 2024-2023 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 13th at 3PM EST

• Applications Must Demonstrate
  – Your interest in EdTech and/or Learning Science
  – Past relevant experience/training
  – Plans after you graduate

• GRE 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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