METALS
Masters of Educational Technology & Applied Learning Science

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


Vincent Aleven


Sharon Carver


Jessica Hammer


Erik Harpstead


Lauren Herckis


Ken Holstein


Ken Koedinger


Marti Louw


Marsha Lovett


Bruce McLaren


Amy Ogan


Carolyn Rose


John Stamper


Nesra Yannier

Overview

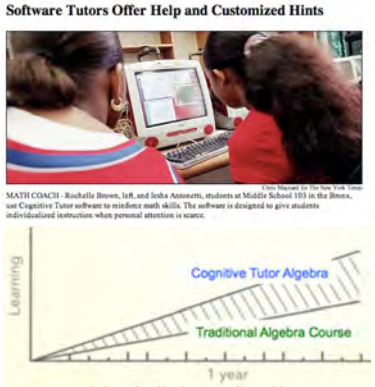
- **CMU & METALS are unique**
- Curriculum
  - Capstone
  - Courses
- Finances
- Application

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

Many Spinoffs and Local Startups

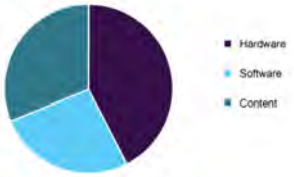
Many Corporate Partners

RENAISSANCE LEARNING
Accelerating learning for all
CENGAGE Learning
EY
Building a better working world
Houghton Mifflin Harcourt
Western Governors University
edmentum
CARNEY
Microsoft
K12
KAPLAN
McGraw Hill Education
turnitin
DDI
BloomBoard
PEARSON
CARNEGIE LEARNING
LONG + LIVE + MATH

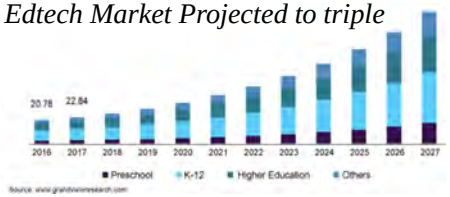
Learning & Training Continues to Boom!!

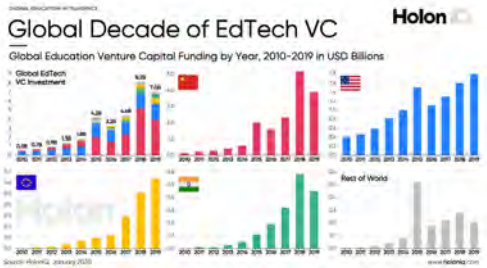
- *New ideas*
- *New technologies*
- *New companies*
- *New careers*

Spending by area



Edtech Market Projected to triple





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/

**http://data.uis.unesco.org/# (2015 data)

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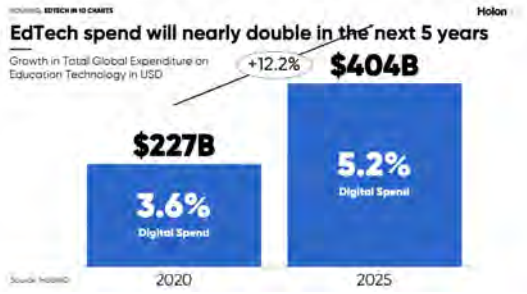
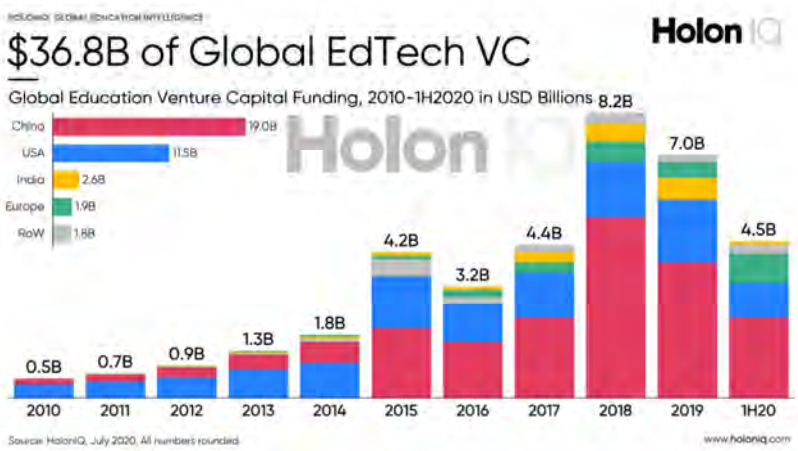
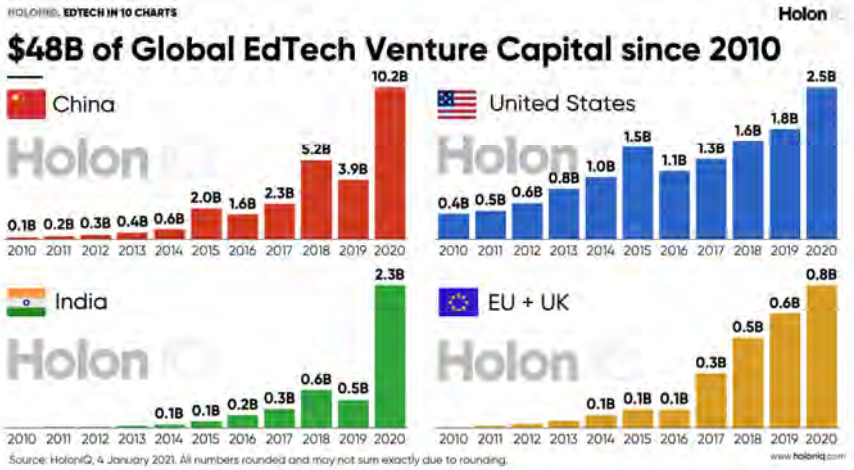


- *Incredible Opportunities*

EdTech Investment Remains High



Venture Capital Growth



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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

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

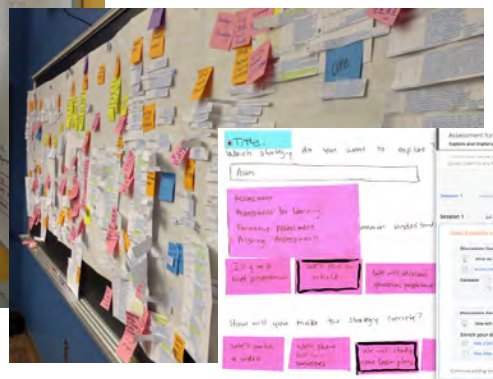
Learn to Create Evidence-Based Innovations in Learning

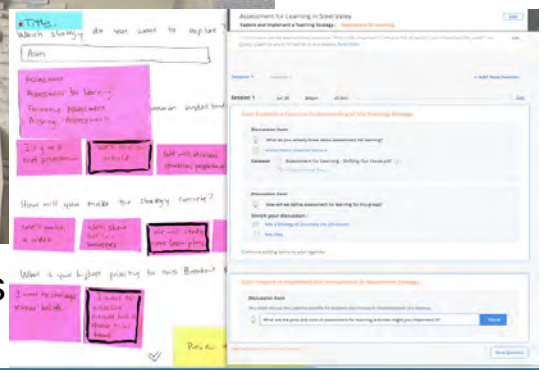
Gather Field Data

Review Literature

Understand Needs

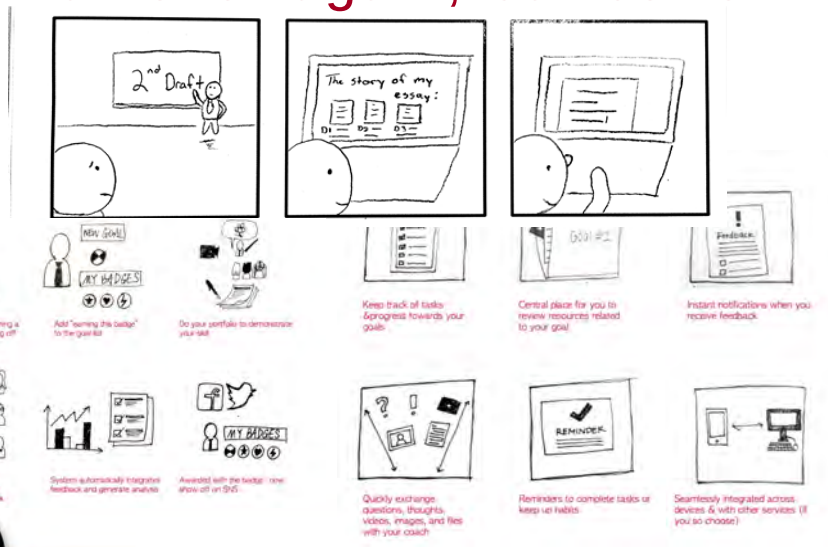
Understand Research





Create Effective Designs

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



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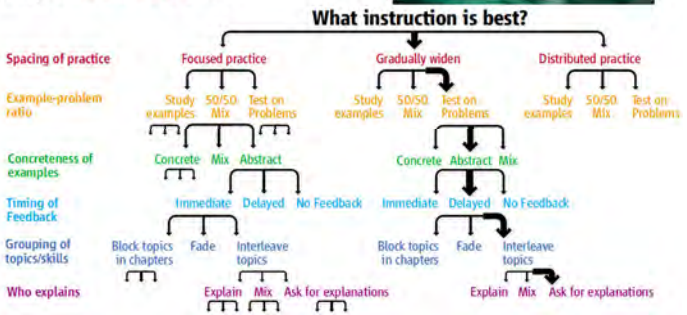
METALS Core Courses

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

E-Learning Design Principles & Methods

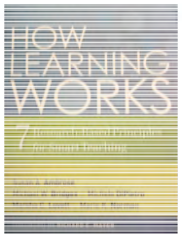
- Gain a *broad understanding* of the field and literature.
- Know when to apply *evidence & theory*
- Learn how to adapt *methods* to specific needs

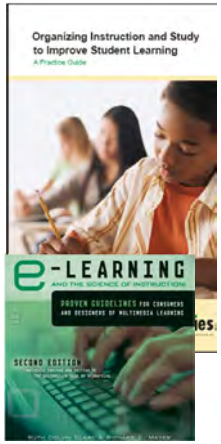
Paulo Carvalho



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)
  - …

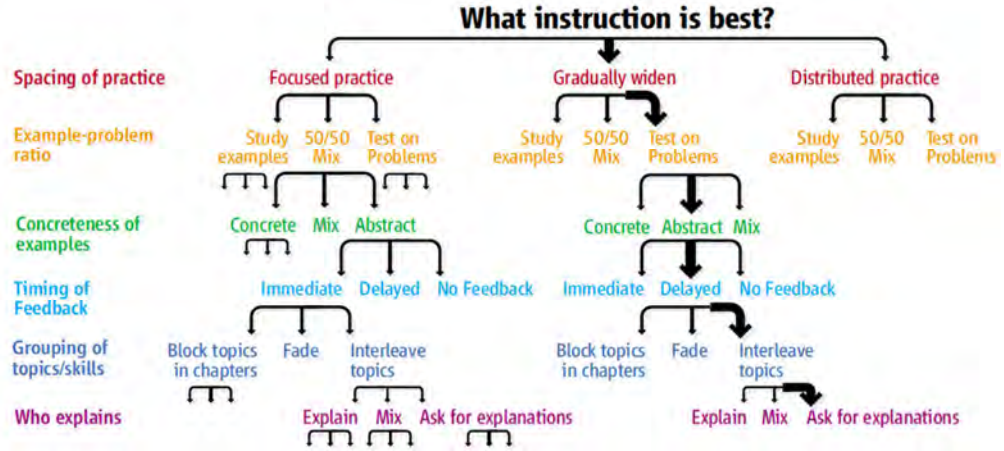




Koedinger, K. R., & Aleven, V. (2007). Exploring the assistance dilemma in experiments with cognitive tutors. *Educational Psychology Review, 19*(3), 239-264.

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

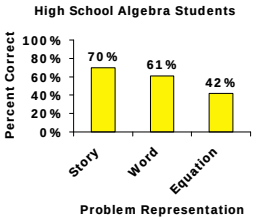
Starting with some number, if I multiply it by 6 and then add 66, I get 81.90. What number did I start with?

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

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

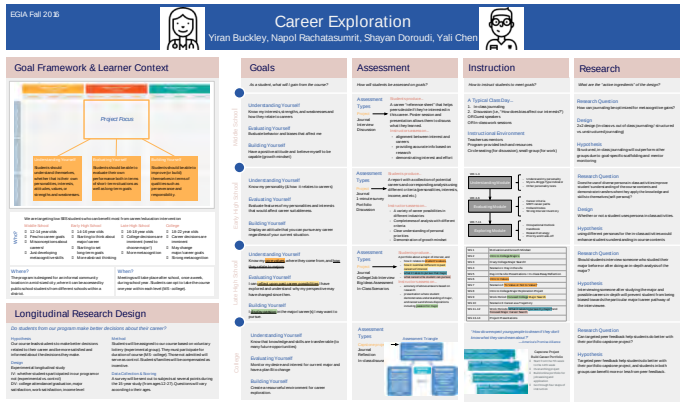
Figuring Out How this All Works…

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



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

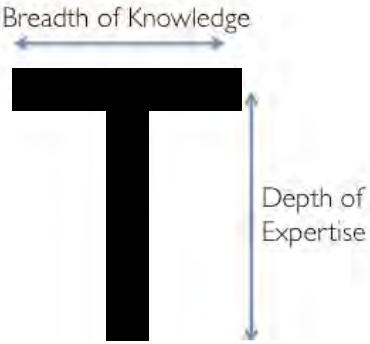
- Design, develop, & implement *innovative, effective, & desirable* educational solutions
- *Innovative*
  - Use state-of-the-art technologies
    AI, machine learning, language technologies, intelligent tutoring systems, mixed reality, …
- *Effective*
  - Apply cognitive & social psychology principles 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
  - https://applygrad.cs.cmu.edu/apply/index.php?domain=1
- 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?

http://metals.hcii.cmu.edu

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