# How to do Human-Centered Research (Case Study: CS Ed)

CMSC 33231 - Diana Franklin

# Welcome / Introductions

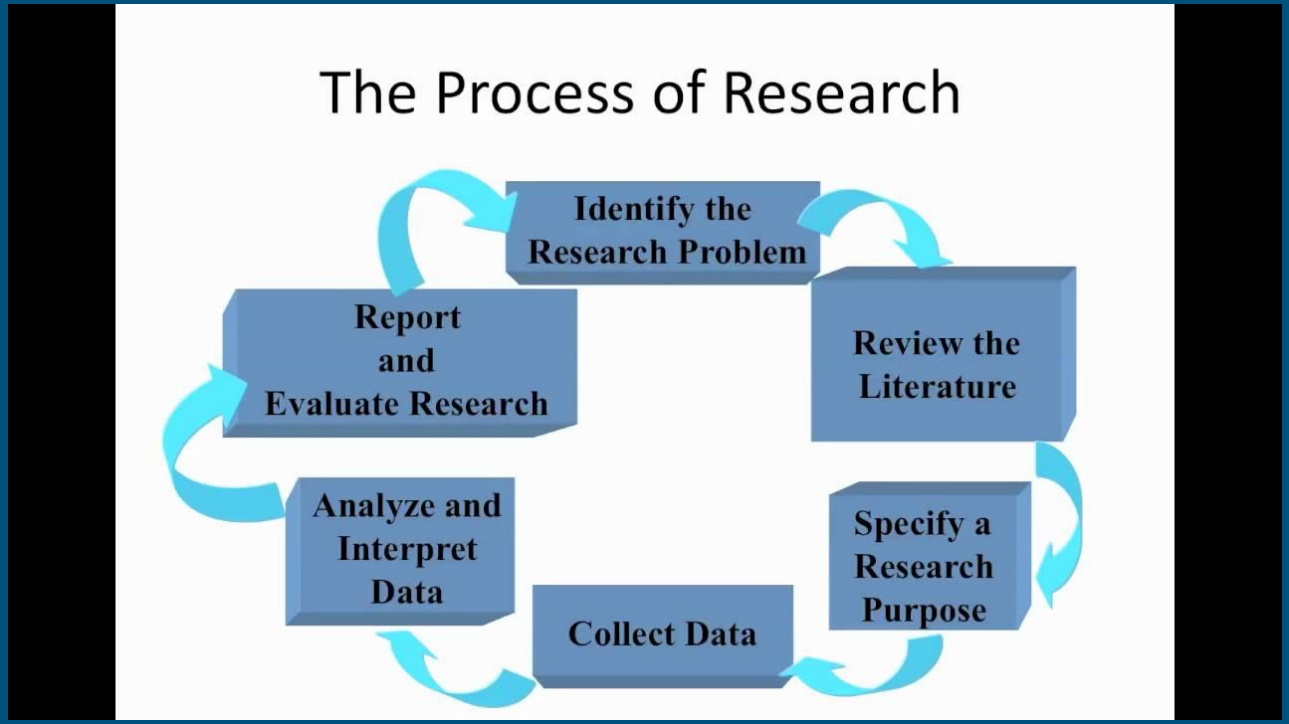
Introduce yourself - name, major, level
What are you interested in learning wrt HCI / CS Ed
One interesting  / unique fact about you

# What is this course about?

**The research process, with an emphasis on disseminating results**

CS Ed research as a case study / example for learning the process

# What is the Research Process?



# Choosing a Research Topic

Need to choose a relevant, reasonable topic you care about

How do you judge your own ideas?!?

# Narrowing to Research Question(s)

Read papers…… Lots and lots of papers.

Theory - learn the foundations, what might be good ideas

Related work - learn where others have gotten - build, don’t replicate

Practicality - do you have a viable group of students on which to pilot / test?

# Critiquing Research Studies

1. Not understanding how to design something that would work for you.
2. Being able to articulate the requirements for and carry out a design for something effective for someone like you.

**Introspection**

3. Being able to articulate the requirements for and carry out a design for something effective for a wide variety of people.

**Listening, Empathy**

# Creating a Research Design

Methods:

- They need to answer the research question
- They need to be practical and reasonable to accomplish

# Do the research

Collect data

Analyze data

# Write a paper

Engage the reader - make them care

Make your case with theory, related work, and your idea

Present reasonable methods

Visualize data

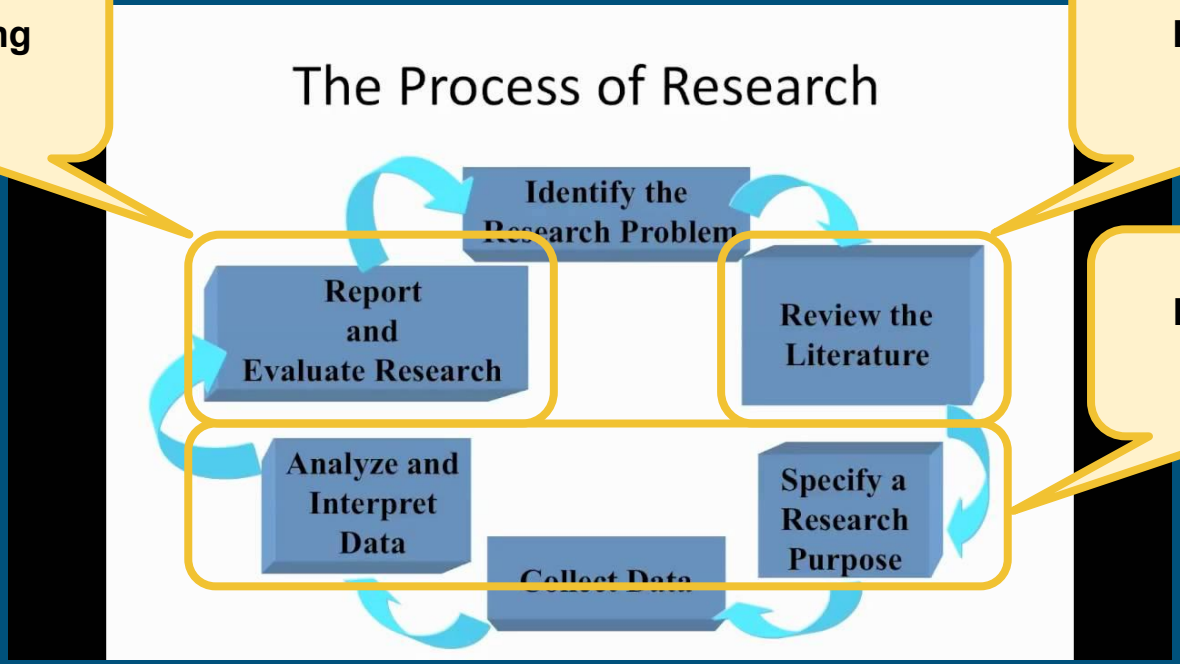
Explain data

Make conclusions based on data

**Not just dry data - need to weave a story / narrative that makes them want to care!!!**

# 33231 Approach

**Presenting**
Papers




**Reading**
Papers

**Reviewing**
Papers

# Assignments

Read and review at least 2-3 papers / class period (every week)

- At beginning of quarter, answer mostly *what they did*
- By mid-quarter, critically review *whether they did it well*

Choose and present a paper, every n/2 class periods, where n is the number of students in the class

# Choosing a Paper

CHI, SIGCSE, ICER

Experimental - must have users and a study design

# Initial Critique Focus

1. Flawed Study: Study design and/or data analysis did not test whether design worked for a narrow population.
2. Small Narrow Study: Study design and/or data analysis tested whether design worked for a narrow population but was too small to generalize.
3. Narrow Study: Study design and/or data analysis tested whether design worked for a narrow population.
4. Small Broad Study: Study design and/or data analysis tested whether design worked for a broad population but was too small to generalize.
5. Broad Study: Study design and/or data analysis tested whether design worked for a broad population.

# In-class Activities

Discuss papers

- What was their idea?
- How did they analyze it?
- **What do you think about it? Do you think it would have worked for you? (why or why not)**
- How does it relate to other things we've / others have read?

In groups, you answer the following question

- What makes papers successful in _____ (enter attribute here)?
- What are the limitations in the research design?
- What are next research steps?

# Grading

30% Paper reviews

20% Presentations (Weight increases later in the class)

50% In-class attendance & participation

# Why is sharing important?

- You can learn from others’ learning experiences.
- Others can learn from your learning experiences.
- Designing only for yourself is useless.
- Learning about what didn’t work for others helps us design better.

# What are limitations on sharing's benefits?

- Our group is not representative - echo chamber
- Tend to weigh anecdotes over published research

# What classroom environment do we want? (attributes of a positive environment)

Inclusive - everyone in the class feels they belong

Feeling like you can say whatever's on your mind, any topic*

- Be mindful of how your rhetoric can affect other people

Feeling like the ideas you share are being heard and taken into account

Disagreements can be respectful and not taken personally*

- Disagree with the idea, not the person (be careful with language)

# What classroom environment do we want? (attributes of a positive environment)

Respectful

Attentive to what others are saying

Encouraging

Constructive Discussion (even in the face of disagreement)

Collaborative

Open to early-stage ideas

# What classroom environment do we want?

**Helpful words / actions**

**Unhelpful words / actions**

# What classroom environment do we want?

**Helpful words / actions**

- Listening
- Acknowledging merits of comment before criticizing
- Awareness of different fields

**Unhelpful words / actions**

- Overly negative feedback
- Not responding to comment - changing subject

# What is required for a positive learning environment?

- The entire purpose of sharing is to learn from others not like you.
  - What is normal to you is not normal to others
  - Struggles, challenges are all a normal part of the learning process
- A safe space
  - Only positive responses to sharing
  - Only positive statements about others
- We must all respect, inside and outside the classroom, each other's experiences

# Our HCI Context: CS Education

Research Process applies to any human-centered field

We will study details of CS Education, which you can apply to other areas

- Most HCI involves learning of some sort, so not too far off

For your papers, you may choose any paper from CHI (main conference)

# Readings for Next Class

Efficiency of Learning from Proof Blocks vs Writing Proofs
https://dl.acm.org/doi/10.1145/3545945.3569797

Using Foundational CS1 Curricula for Middle School & Early High School Computer Programming Education
https://dl.acm.org/doi/10.1145/3545945.3569877

It is in gradescope already!! Let me know if you haven't been added to Gradescope for the course!

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# Paper choosing / presenting assignments

Thursday 3/23 - Diana

Send me paper choices by Thursday 3/23 5pm

Tuesday 3/28 - J.L.  D.M.

Thursday 3/30 - S.N.  M.T.

Send me paper choices by Thursday 3/30 5 pm

Tuesday 4/4 - _____  _____

Thursday 4/6 - _____ _____

# The Role of Theory: Maslow's Hierarchy of Needs

Guides what you design

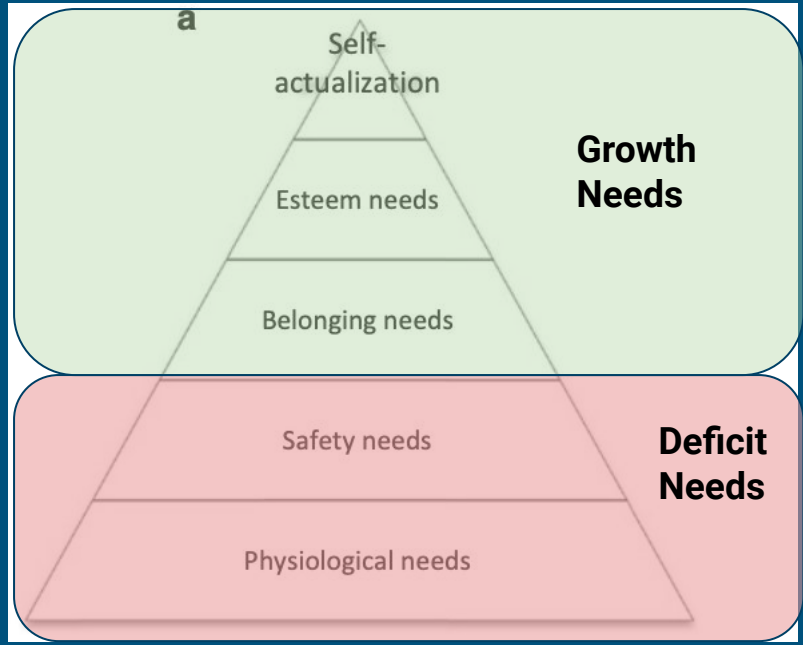
Trauma-informed curriculum

Guides how you analyze data

Collect info, calculate values based on Maslow's categories

Guides how you interpret data

Explain results based on adhering to or not to hierarchy

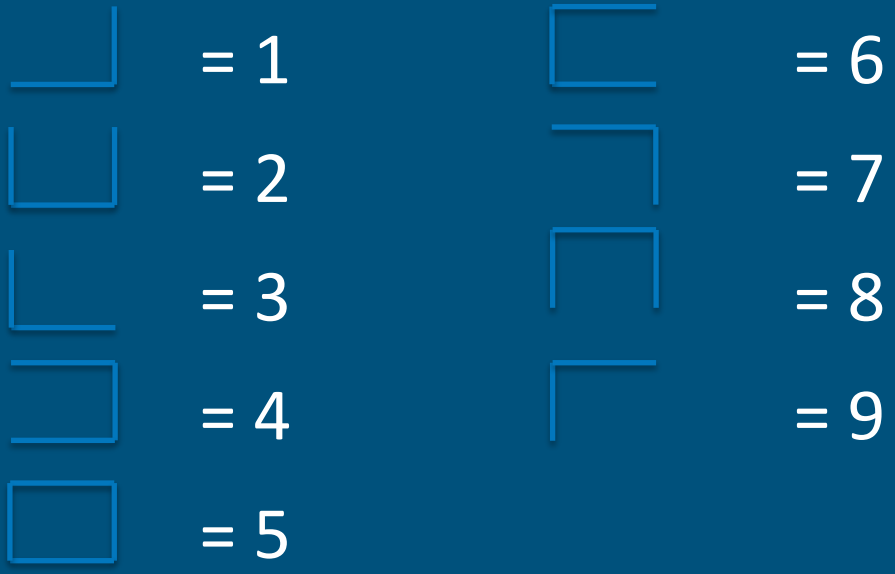


# Anti-Constructivism: Sage on the Stage

# Constructivism

1. People understand through lens of existing knowledge
    a. The world is round - like a pancake or a ball?
2. They are active participants in building their knowledge / creators of knowledge

# Designing Curriculum: Theory: Constructivism



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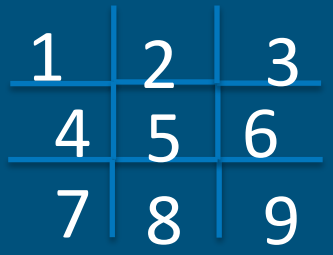
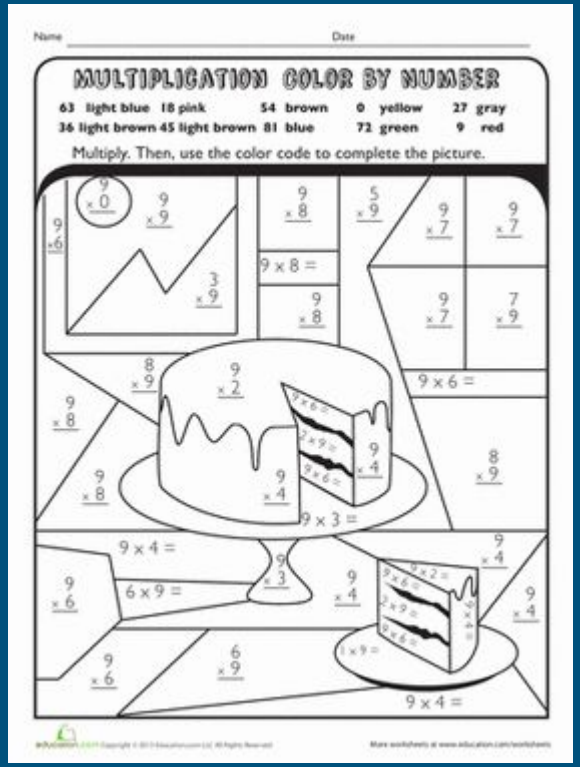


# Designing Curriculum: Theory: Constructivism

# Anti-Constructionism:



# Constructionism:

1. Constructing something
2. Personally meaningful, self directed
3. Public sharing of artifact

Similar ideas outside of CS Ed?

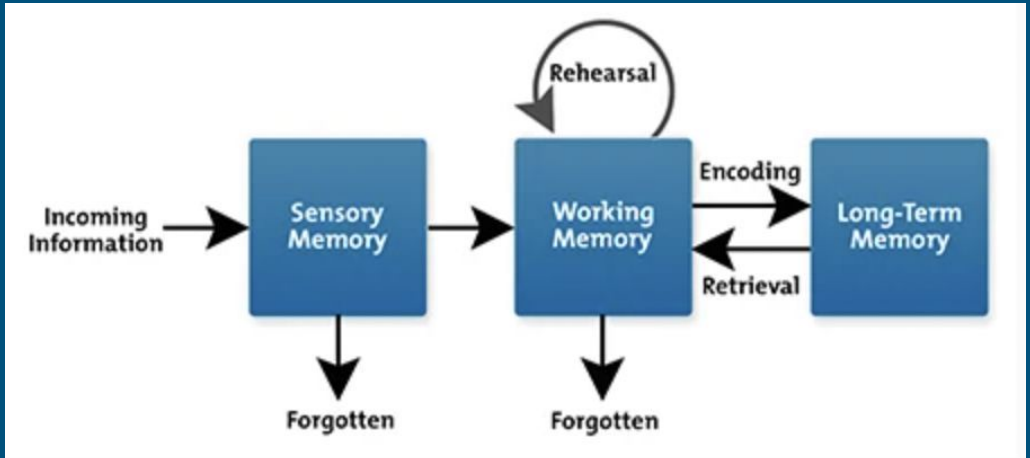
Inquiry-based learning
Open-ended projects

# Cognitive Load Theory

Your mind:

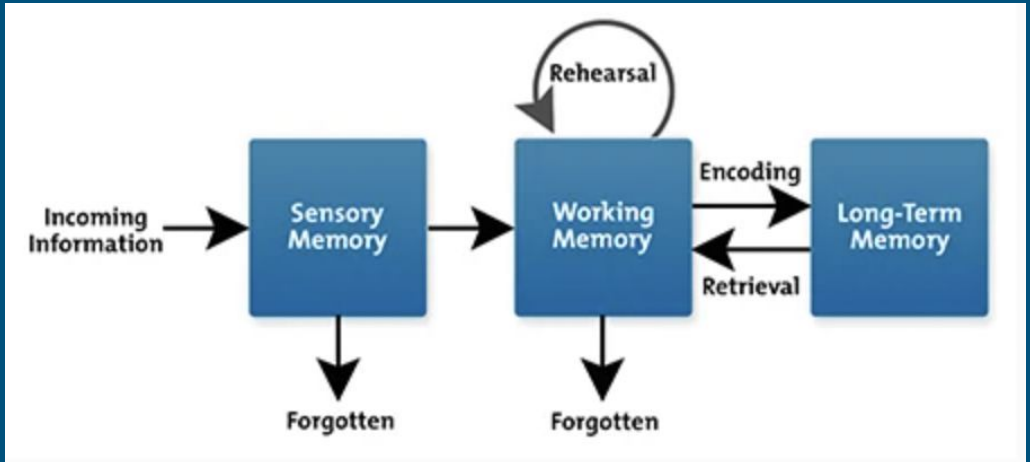
- Has a limit on information
- Filters information

Instructional interventions should limit the amount of information so it doesn't fill up working memory




Adapted from Atkinson, R.C. and Shiffrin, R.M. (1968). 'Human memory: A Proposed System and its Control Processes'. In Spence, K.W. and Spence, J.T. *The psychology of learning and motivation*, (Volume 2). New York: Academic Press. pp. 89–195.

# Which is easier?

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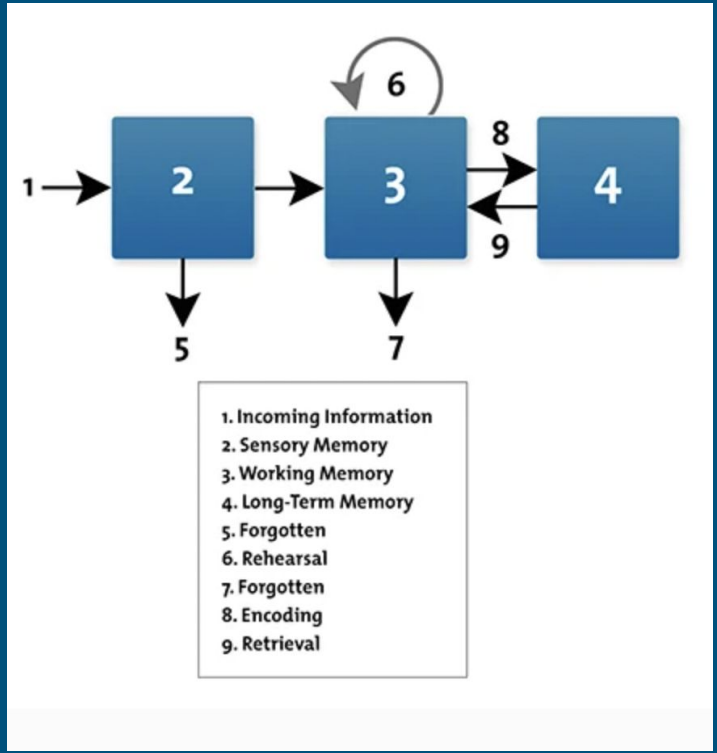
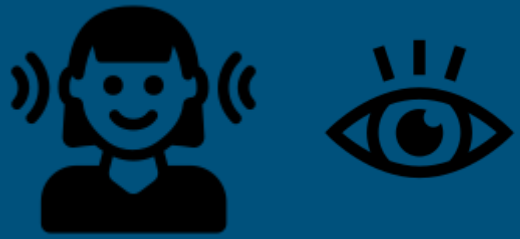


# Two additional features

Visual and Auditory information do not compete (“Modality Effect”) - better to narrate than add clutter to diagram



Learned information in scheme treated as a single grouped item. Therefore, mastery before new things is better than learning many new things at once.

# CLT Education Guidance

Adapt Presentation to Expertise

Reduce the Problem Space (amount to learn)

Integrate pieces of information rather than presenting separately

Take advantage of auditory + visual channels

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