Expect Today...

- How people learn
- Practicum: anticipating difficulties
  - in teaching
  - in assessing
Learning Goals: CSE 599

5. Describe a specific lecture/discussion activity or homework assignment for a computing course that engages students in metacognitive assessment.
6. Write lecture-level learning goals for a course that are clear and assessable.
12. Observe and critique someone else’s lecture with regard to student learning.
The Reading

- How People Learn: Brain, Mind, Experience, and School
  - National Research Council
  - Committee on Developments in the Science of Learning
    • John Bransford, Ann Brown, Rodney Cocking, Eds.

Goal: apply concept from reading to actual practice
What would the reading say about the following statements?

• Lectures are not a useful way for students to learn.
• It is not important to learn facts.
• Students learn mostly through a process of trial and error.
• Students should actively participate in their learning.
Development of Science of Learning Constructivism

• All new learning is based in pre-existing knowledge that you hold.

• You store things in long-term memory through a set of connections that are made with previous existing memories.

• "Creating memories" (aka learning) involves having neurons fire and then link up in networks or patterns.
Key findings / implications

• Students come to the classroom with preconceptions about how the world works. If this initial understanding is not engaged, they may fail to grasp the new concepts and information that are taught, or they may learn them from the purposes of a test but revert to their preconceptions outside of the classroom.

• How can we draw out and work with preexisting ideas?

• What does a learner-centered classroom look like?
Activity: Leveraging prior knowledge

What are the values of `a` and `b` after the following code executes?

```java
int a = 10;
int b = a;
a = 12;
```

- What do you think are the common incorrect answers to this question?
- Why?
- What prior knowledge might be getting in the way of the student getting the right answer?
- What prior knowledge would help students?
Key findings / implications

• To develop competence in an area of inquiry, students must:
  - Have a deep foundation of factual knowledge
  - Understand facts and ideas in the context of a conceptual framework
  - Organize knowledge in ways that facilitate retrieval and application

• Teachers must teach in depth, providing many examples in which the same concept is at work, and providing firm foundation of factual knowledge.

• In a knowledge-centered environment, attention is given to what is taught (information, subject matter), why it is taught (understanding), and what competence or mastery looks like.
Key findings / implications

• A "metacognitive" approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their own progress in achieving them.

• The teaching of metacognitive skills should be integrated into the curriculum.
  – Cognitive apprenticeship

• Formative assessments are critical: they make students' learning visible to both students themselves and their teachers.
Take-aways

You must consider your students' prior knowledge.

You are helping students build a conceptual model - this model must be consistent across all aspects of the course.

Students should be actively engaged in their learning.

Facts / skills are important, but students (and you) must know how they fit into the larger framework of the course content.

Know what mastery looks like. Demonstrate it. Assess it.
Putting into practice in discussion

Find out and articulate students' prior knowledge.

Align your examples with the instructor's (consistency).

Know the larger context, and present it.

Model mastery.

Engage students actively.
Practicum: Leveraging prior knowledge

• Select one of the following topics
  - Pointers in C++
  - Variable scope (e.g. when the same variable name is used in multiple scopes)
  - References vs. primitives
  - Strong vs. weak induction
  - Reductions to prove uncomputability or NP-hardness

• What prior knowledge might help / get in the way of students' understanding?

• Design an example / exercise that will help draw out students' misconceptions

• Design an example / exercise that will help teach the concept by building on prior knowledge.
Homework for Next Time

• Weekly: Check class website for assignment

• Assignments
  - Take Teaching Perspectives Inventory
  - Post on Piazza about it
  - Prepare new discussion presentation, taking into account what you've learned in CSE 599 so far