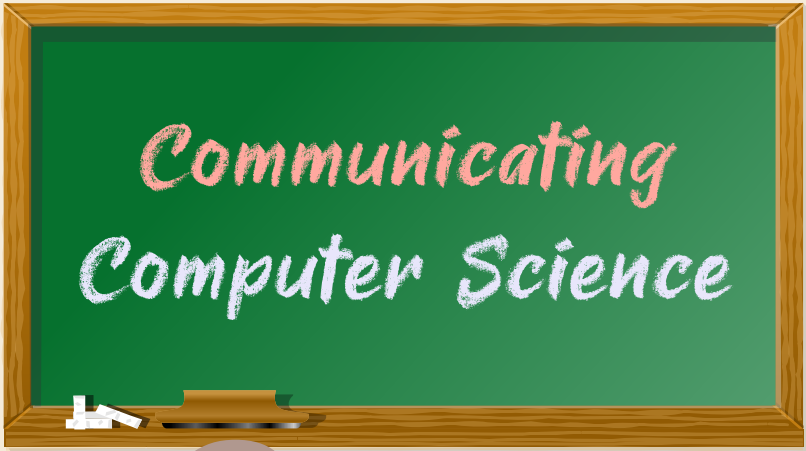

3 Motivation & Learning Theory

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Outline

Goal for this unit

- Give you the **vocabulary** to talk about theories of learning.
- List some best practices for teaching.

3.1 A Warning

Pre-session activity

Not every theory that "appears plausible" is true

⇝ Don't follow advice blindly!

In particular: Do **not separate** your class by learning styles.

⇝ This example demonstrates the importance of empirical research in education.

- But there is a lot of truth in the original observation:
  - We can represent the same material in different ways.
  - *visual*, *auditory*, *read/write*, and *kinesthetic* are good categories for representations.
  - Different representations of material do help.
    But you want to show them together. That helps everyone.

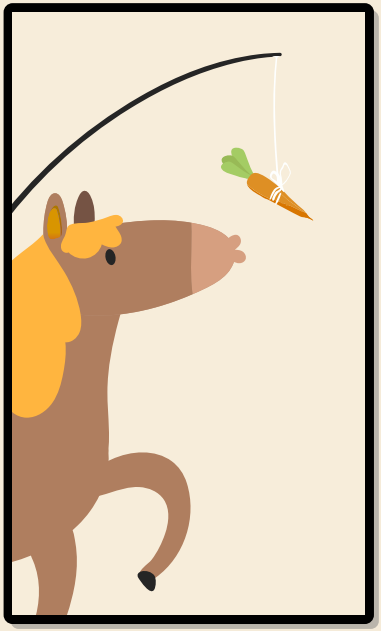
- . . . and comparing VARK profiles still kinda fun 😉

3.2 Motivating Learners

Forms of motivation

- **extrinsic motivation** *"carrot and stick"*
  - marks/grades
  - rewards (Gold Stars, Dojo points, teacher's awards, . . .)
  - punishment
  - fear/pressure
- **intrinsic motivation**
  - interest in a task
  - task is enjoyable, fun
  - ambition to achieve a specific goal
  - curiosity
- largely agreed:
  intrinsic motivation is much stronger
  extrinsic measures may do more harm than they help

⇝ *How can be foster intrinsic motivation?*
Where does it come from?



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Expectancy-Value Theory

Key factors for (intrinsic) motivation:

1. **Subjective *value* of a goal**

   "Do I care about this? Does it help me?"

2. ***Expectations* for attainment of a goal**

   "Am I likely to succeed? Do I have the skills?"

more details: `https://www.queensu.ca/teachingandlearning/modules/students/15_motivation.html`

Barriers for motivation can arise from both factors!

How can we make learning matter to students?

- Connect material to learners' environment
  - Solve a (small) real problem
  - Explain how something works that students use every day
  - Discuss the history of a topic
  - Show how something can serve society at large / a greater cause
- Use humor and stories
- Give students choices (over topics, learning paths, modes of learning)
- Embed creative tasks

It's hard! And it takes lots of creativity!

Social motivation

- Apart from learning material, **social context** plays important role
  - It can be motivating if there is a sense of belonging
  - Good group work can add to a tasks value

- But: classroom climate can also alienate if you feel as an *outsider*
  - underrepresented gender, culture, race, age, religion, sexual orientation
  - English as additional language
  - neurodiversity, learning impairments, disabilities

- **Best practices**
  - Establish class social rules, classroom as safe zone
  - Avoid stereotypes
  - Use diverse personas in examples

Growth Mindset vs. Fixed Mindset

Growth Mindset

- "Mistakes are opportunities to grow."
- "I am **not yet** there."
- "This is hard; I'll have to break it down / ask for a hint / keep trying."
- "She seems ahead in maths, maybe we can offer her stretch tasks."

Fixed Mindset

- "Mistakes show everyone how stupid I am."
- "I cannot do this."
- "I'm not good at math."
  (What's the point of trying?)
- "She is a maths brain."
  (So no need to challenge her.)

Good news: No scientific evidence for fixed mental capabilities!

- ⇝ fixed mindset is only within us!
- ⇝ Ban it from your teaching.

3.3 Theories of Learning

Learning Theories

What does it mean to learn something?

Behaviorism / Instructionism

- Learning = measurable change in learner's behavior
  - Pavlov's dog (reinforcement learning)
  - repetition, drill exercises
- Teacher delivers material to learner
  - teacher has the key active role
  - teacher decides structure, content, activities
  - learning mostly seen as one-way street: from teacher to learner
- emphasis on summative assessment

Constructivism

- Learning = change in learner's mind, learning as a transformation
  - Piaget's observation of children
  - through experience, concepts form
  - exploratory/discovery tasks, play
- teacher = guide on learning journey
  - learner has key role; teacher only facilitates
  - teacher set environment, organizes learning opportunities
- emphasis on learner's experience

Piaget's counter experiment https://www.youtube.com/watch?v=gnArvcWaH6I

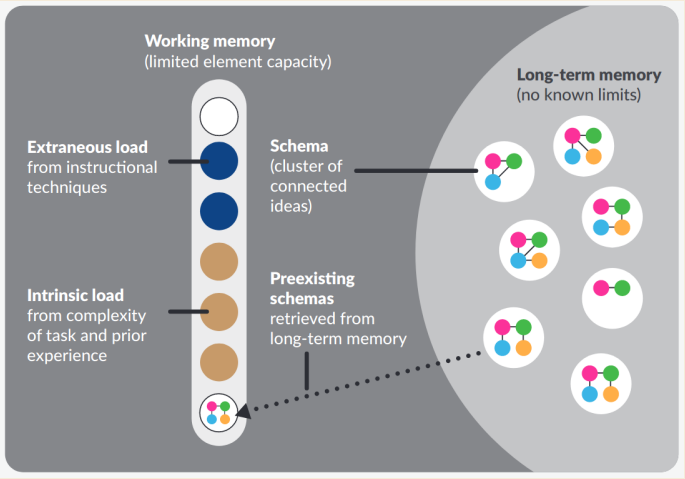
Constructivism-only fallacy

- It is tempting to condemn instructionism and to focus on open exploratory activities
  - works great for children already motivated to learn something
  - often overwhelms others!
    "What do I have to do now?"

⇝ Provide guidance & scaffolding

- use quizzes to trigger exploring a specific question
- de-brief: "This is what could be observed here."

Cognitive load theory



- Working memory is **very** limited
  - ≈ 7 chunks
- But: each chunk can be complex *schema* if it is already internalized

⇝ need tasks of appropriate size/complexity

⇝ need to connect concepts to existing knowledge

https://blog.teachcomputing.org/pedagogy-bytes-quick-reads-for-busy-educators/

Bloom's Taxonomy

Streamlined version of Bloom's Taxonomy for CS
as used for ACM Curricula Recommendations

3 levels of **mastery**

- **Familiarity:**
  The student understands what a concept is or what it means. This level of mastery concerns a basic awareness of a concept as opposed to expecting real facility with its application. It provides an answer to the question "What do you know about this?"

- **Usage:**
  The student is able to use or apply a concept in a concrete way. Using a concept may include, for example, appropriately using a specific concept in a program, using a particular proof technique, or performing a particular analysis. It provides an answer to the question "What do you know how to do?"

- **Assessment:**
  The student is able to consider a concept from multiple viewpoints and/or justify the selection of a particular approach to solve a problem. This level of mastery implies more than using a concept; it involves the ability to select an appropriate approach from understood alternatives. It provides an answer to the question "Why would you do that?"

⇝ Use the taxonomy to balance assessments