

# 2

## Motivation & Learning Theory

*14 October 2021*

Sebastian Wild

# Outline

## 2 Motivation & Learning Theory

2.1 A Warning

2.2 Motivating Learners

2.3 Theories of Learning

## Goal for this unit

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

## 2.1 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.



## 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.

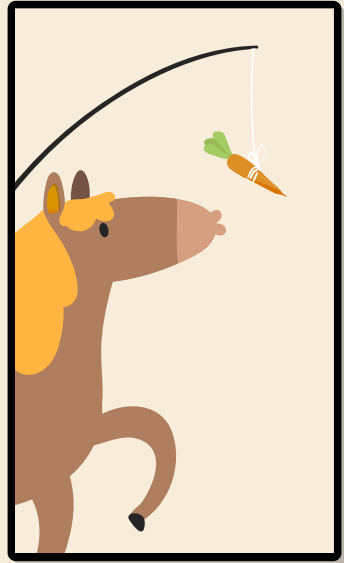
- ▶ But there is a lot of truth in the original observation:
  - ▶ We can represent the same material in different ways.
  - ▶ *visual, auditory, read/write, and kinesthetic* are good categories for representations.
  - ▶ Different representations of material do help.  
**But you want to show them together.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

## **2.2 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?*



Background vector created by rawpixel.com – www.freepik.com

# 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](https://www.queensu.ca/teachingandlearning/modules/students/15_motivation.html)

# 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](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

# 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.)

# 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.

## **2.3 Theories of Learning**

# Learning Theories

What does it mean to *learn* something?

# 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>

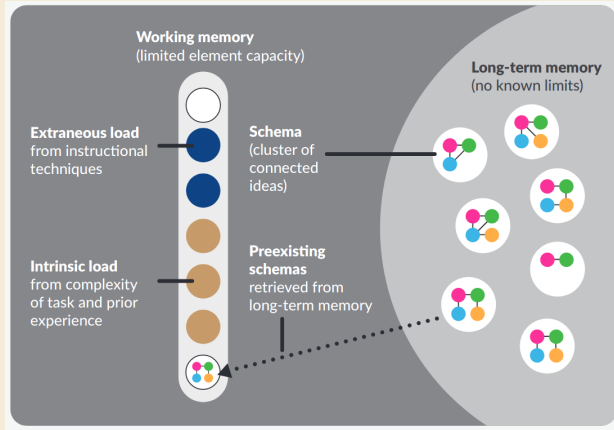
## Constructivism-only fallacy

- ▶ 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**
  - ▶  $\approx 7$  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

*[tiny.cc/ai-course](https://tiny.cc/ai-course)*