Making it Work in the Workplace with Cognitive Load Theory

Justin L. Sewell, MD, PhD, MPH, FACP

Associate Professor of Medicine, University of California San Francisco

Medical Director for Gastroenterology, San Francisco General Hospital

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I have no financial or other disclosures

Objectives

- By the end of this session, participants should:
  - Become familiar with basic tenets of cognitive load theory (CLT)
  - Consider frameworks for thinking about teaching and learning in health professions workplaces
  - Propose applications of CLT within their own workplace teaching or learning settings

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Who is in the room?

- In which type(s) of workplace settings do you teach?
  - Ambulatory
  - Inpatient
  - Primary care
  - Specialty care – cognitive
  - Specialty care – procedural
- What is the most challenging workplace task for you to teach?

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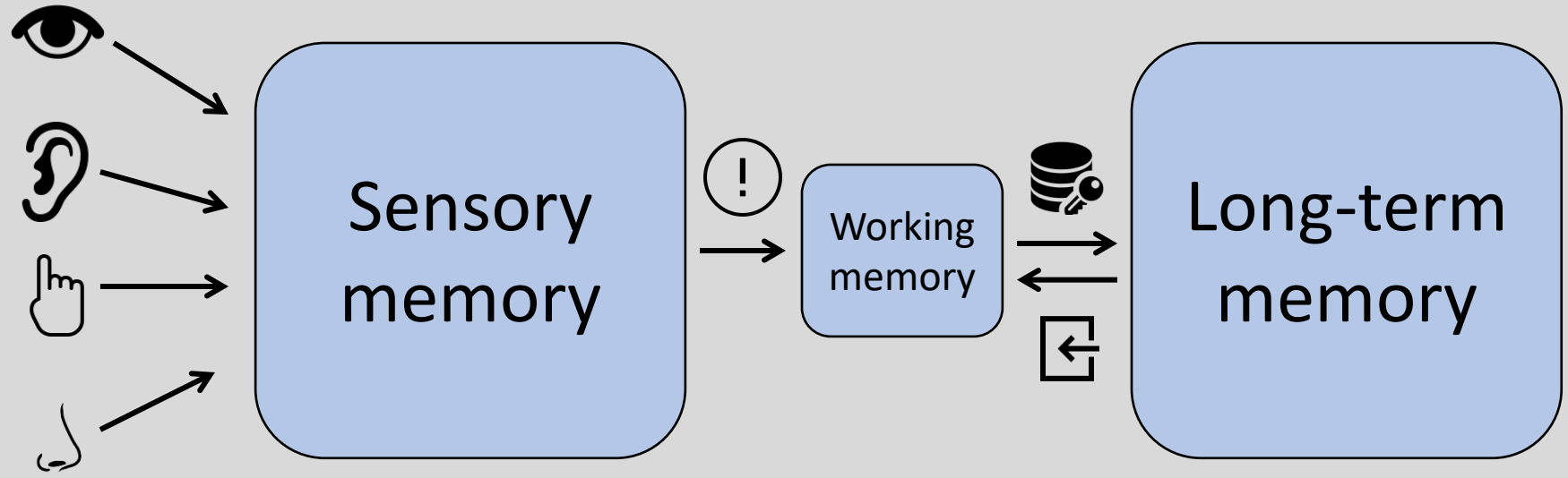
Cognitive Load Theory



Adapted from Young JQ. *Med Teach* 2014.

Types of cognitive load

Intrinsic load: completing elements of learning task → Match

Germane load: forming learning schemas, automation → Promote

Extraneous load: attending to distractions, disruptions → Minimize

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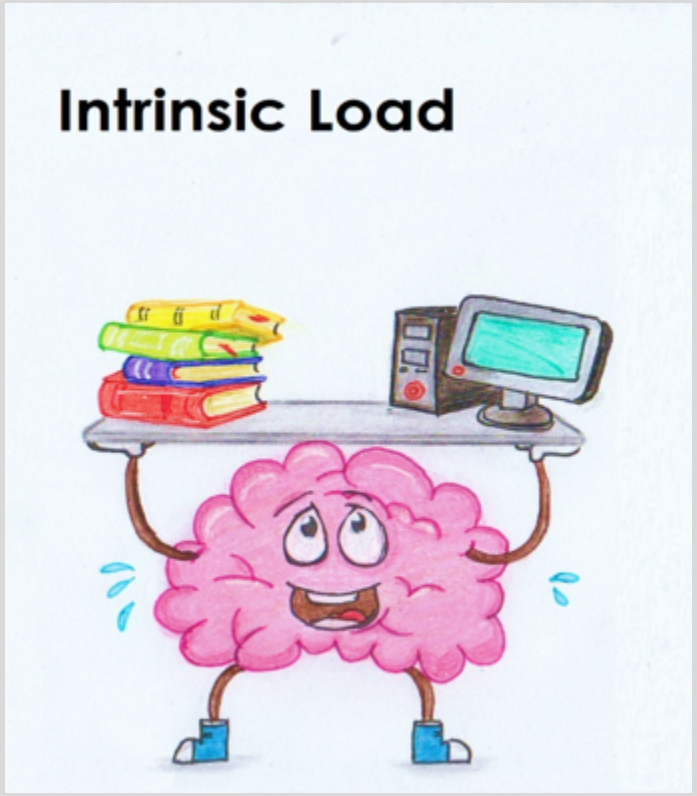

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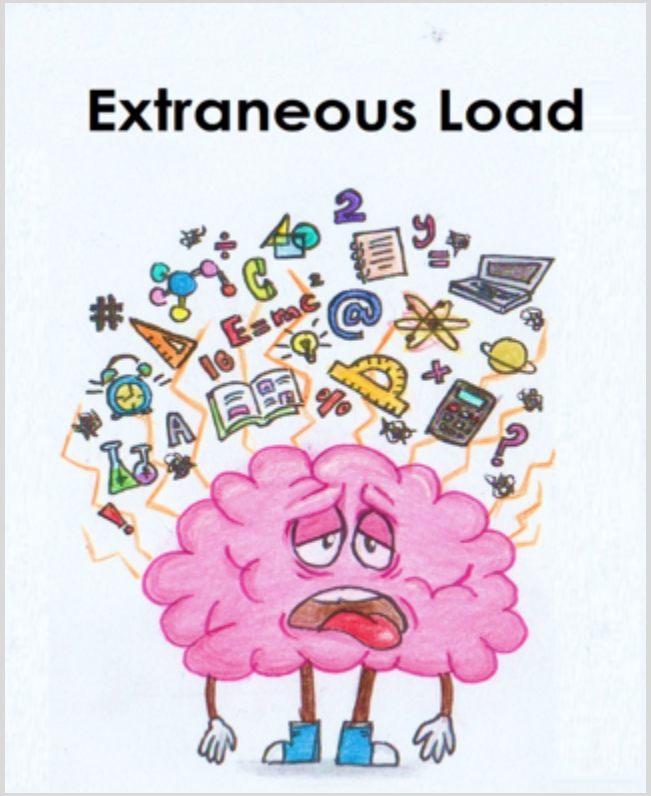

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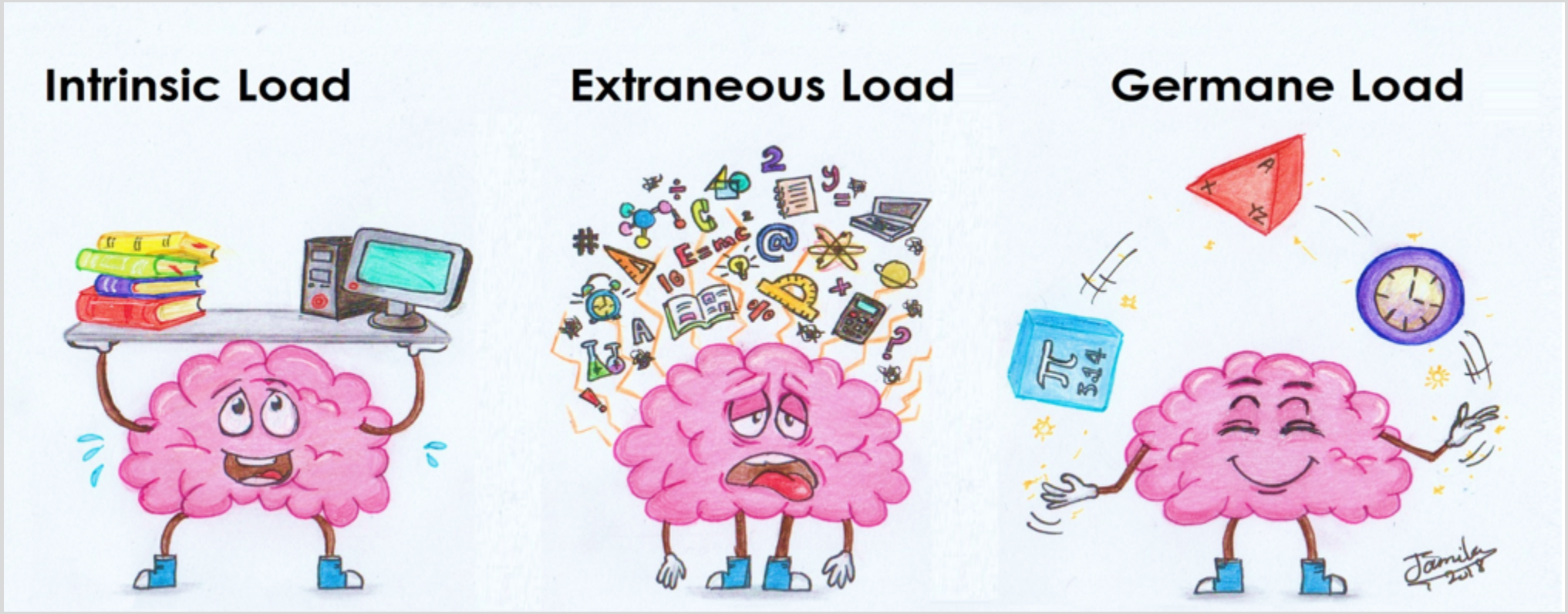

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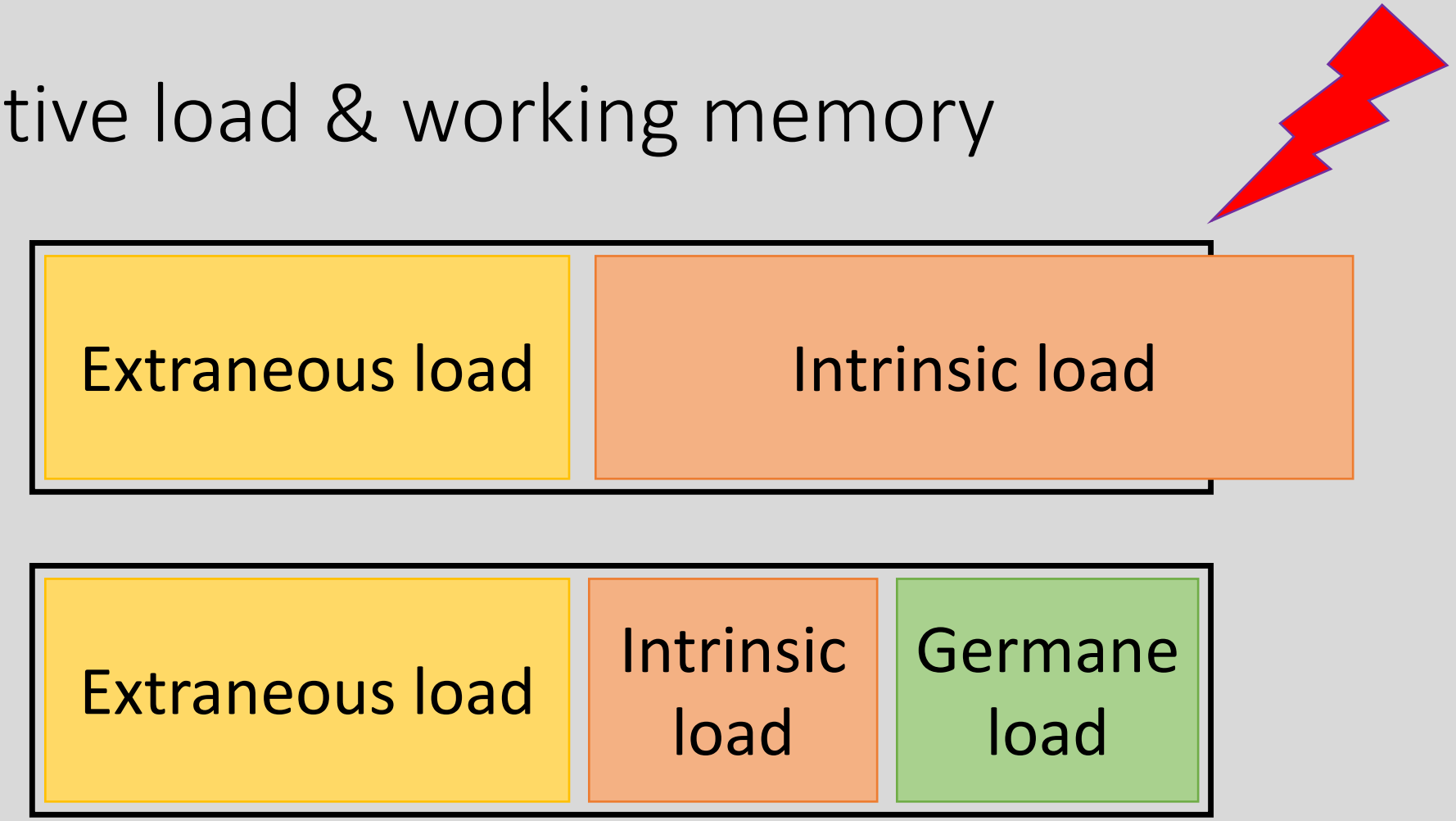
Cognitive load & working memory



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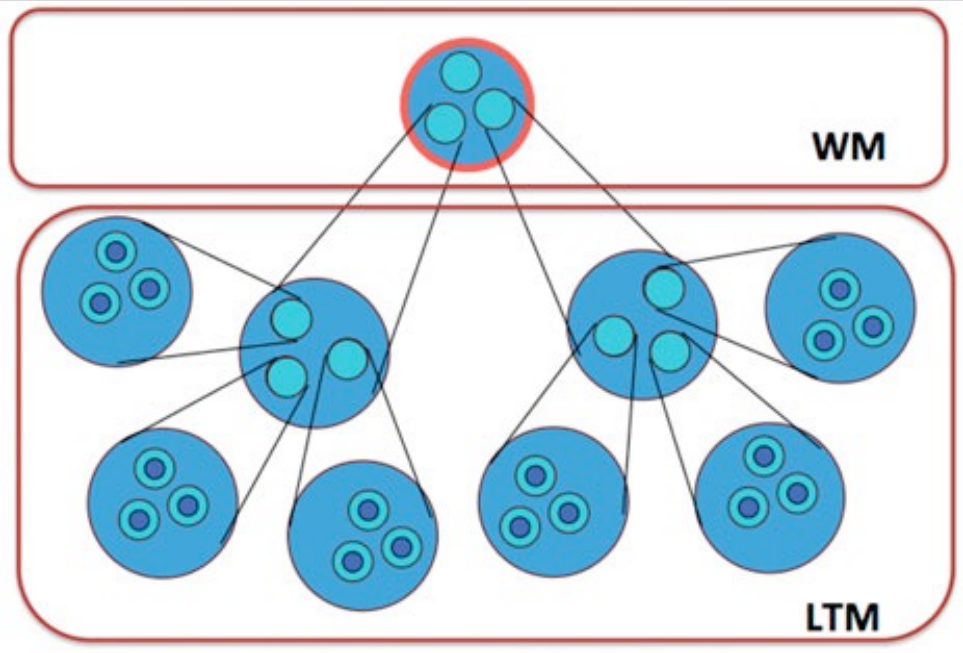
Benefits of schema formation



Young JQ. *Med Teach* 2014.

Automated schemas take little to no space in working memory!

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Single-item instruments
Secondary tasks
Physiological measures

Multiple-item instruments

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Photo by Camylla Battani on Unsplash

Cognitive Load in HPE Workplaces

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Photo by JC Gellidon on Unsplash

Workplaces function differently than classrooms…

Image: https://www.med.uvm.edu/home/2019/08/15/welcomeclassof2023

Image: https://www.cybertalk.org/2019/09/25/hospital-acutely-affected-by-ransomware-attack/

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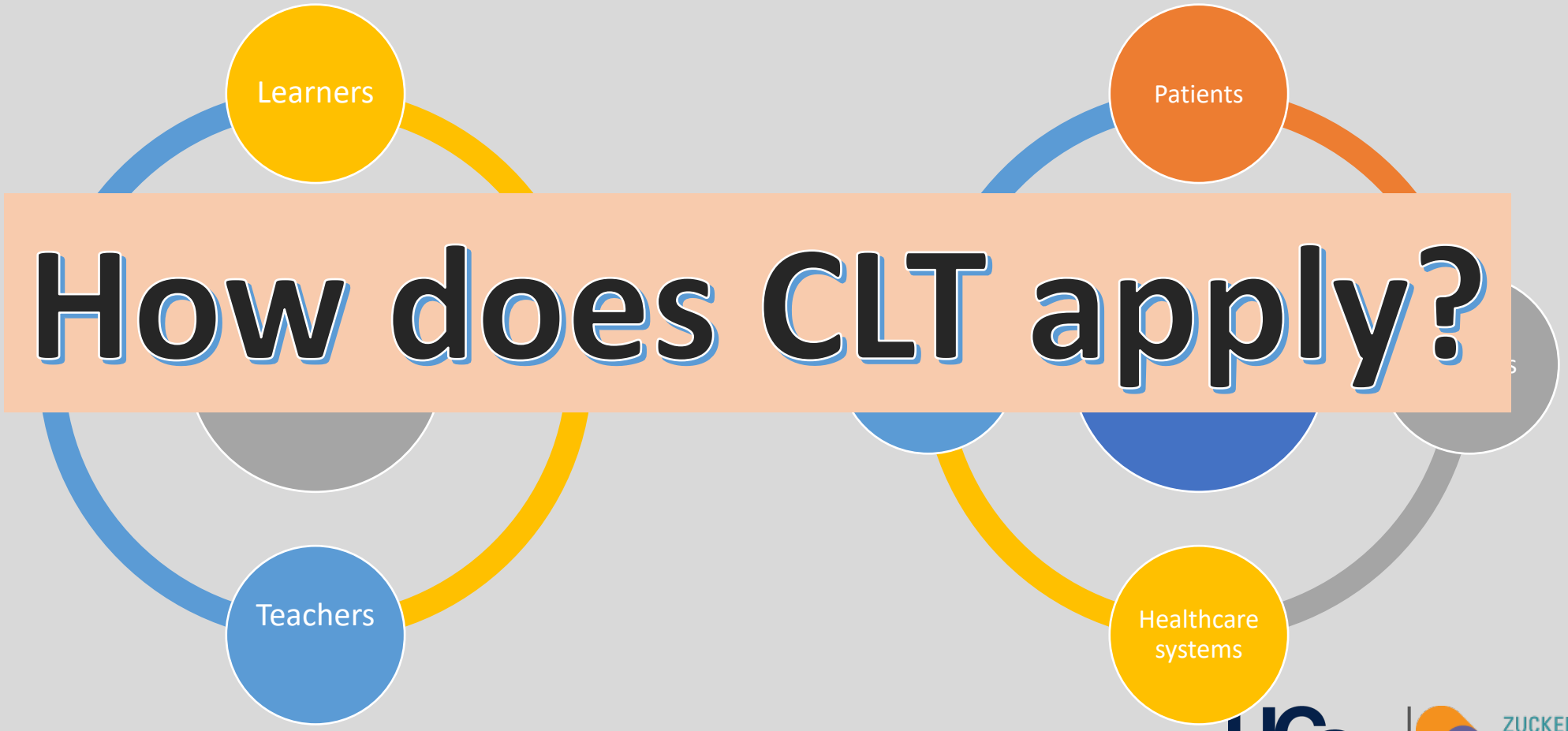
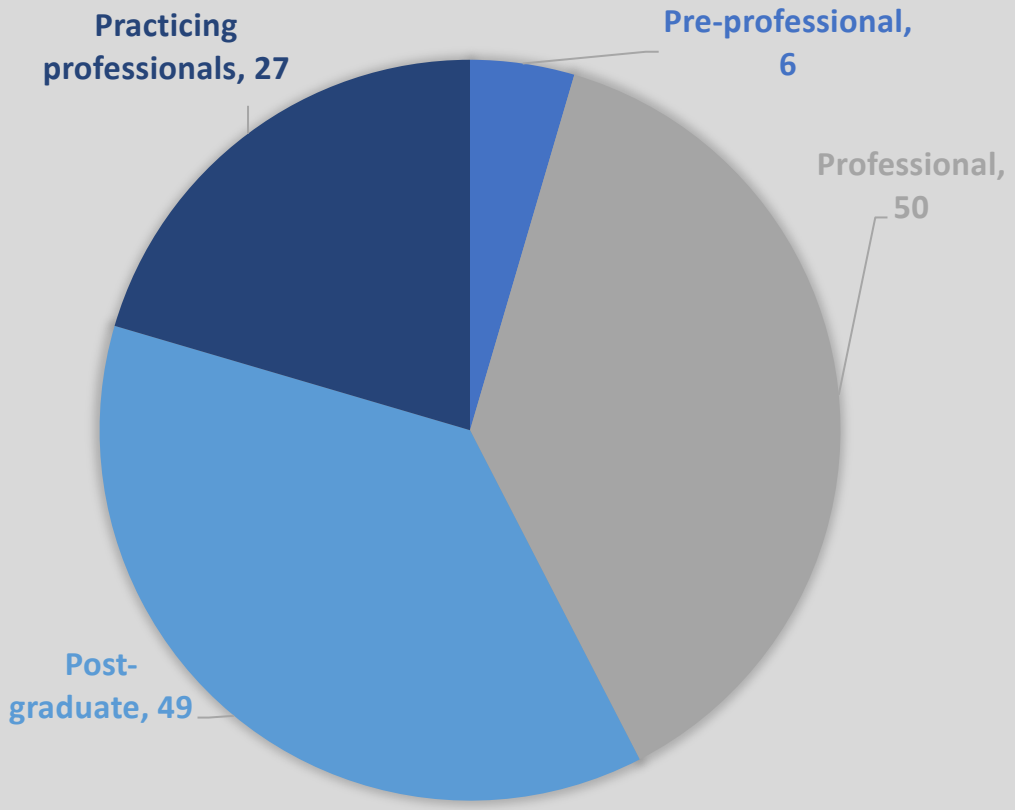
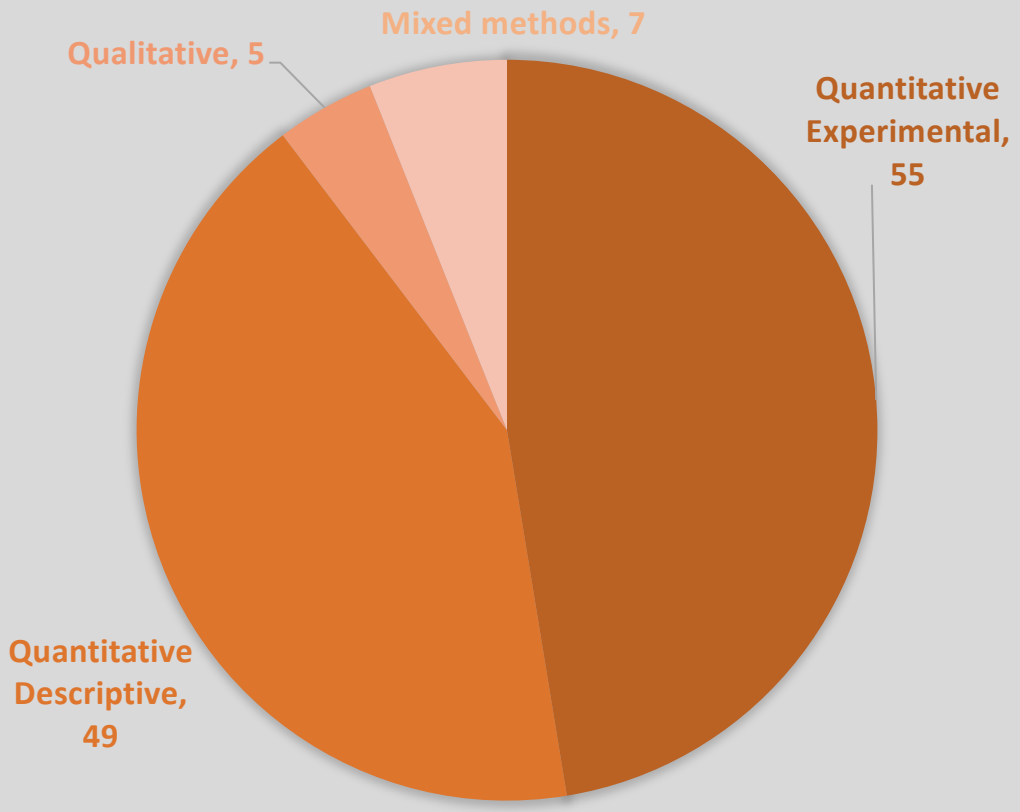
…and have different stakeholders!



How does CLT apply?

Scoping review of 116 studies





Sewell JL et al. *Teach Learn Med* 2019;41(3):256-279.

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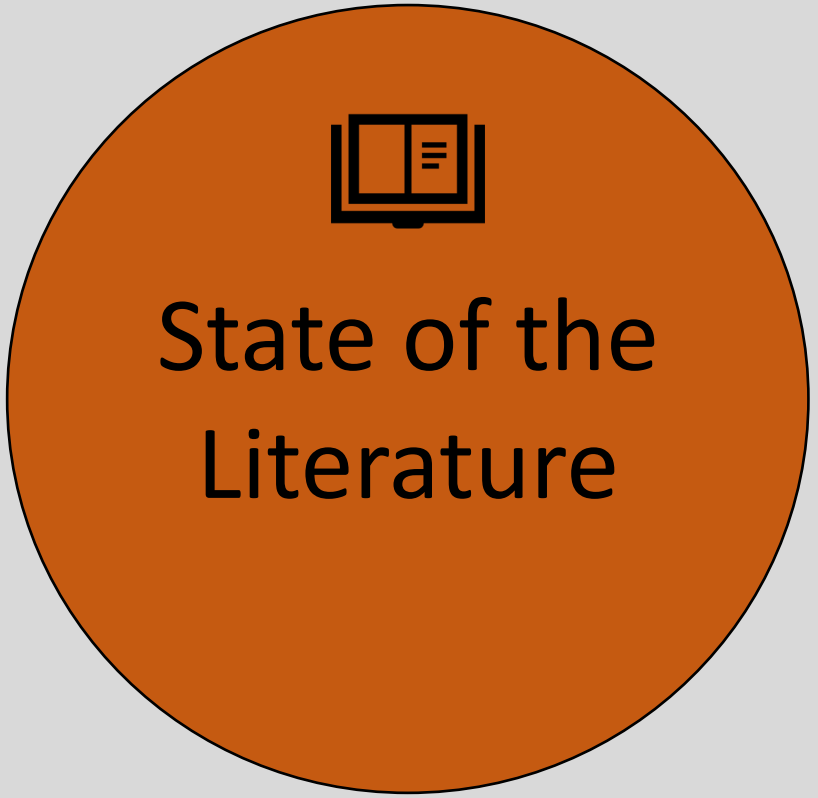

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Drivers of intrinsic load in th (task completion)

Patient load, comorbidities, tasks, data elements

Task Complexity
- **Number informational elements**
- **Element interactivity**
- **Time pressures**

Learner Knowledge

- Uncertainties & contingencies (diagnostic, therapeutic, informational)
- Interactions: disease-disease, drug-drug, disease-drug
- Maturity of disease evidence base
- Patient contextual factors

- Clinical and procedural knowledge
- Idiosyncratic patient assignments

- Urgent, emergent and crisis situations
- Work and team structure

Young JQ et al. *Teach Learn Med* 2016;28(1):88-96.
Sewell JL et al. *Teach Learn Med* 2019;41(3):256-279.

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Literature regarding intrinsic load in the workplace (task completion)

- Mostly used to compare two educational conditions:
  - Simple versus complex simulated tasks (e.g., gyn surgery, cardiac auscultation)
  - Simulated versus authentic tasks (e.g., ENT surgery, clinical reasoning)
- Higher intrinsic load universally associated with:
  - Lesser prior experience
  - Poorer performance

Sewell JL et al. *Teach Learn Med* 2019;41(3):256-279.

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Drivers of extraneous load in the workplace (unproductive processing)

Instructional/Task Design
- **Information search**
- **Modality of information**
- **Team structure**

Distractions

Physiology

- Familiarity with EHR
- Familiarity with hospital system
- Geographical issues

- Graphical versus text display
- Data formatting

- Knowing who to call, when, for what
- Intra-team, inter-team, interprofessional dynamics

- Background noise
- Pagers, mobile devices
- Interruptions
- Internal thoughts or preoccupations
- Negative emotions

- Fatigue
- Response to stress
- Negative emotions

Young JQ et al. *Teach Learn Med* 2016;28(1):88-96.
Sewell JL et al. *Teach Learn Med* 2019;41(3):256-279.

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Literature regarding extraneous load in the workplace (unproductive processing)

Higher fidelity simulations

Patient contextual factors

Multi-tasking and time pressures

Distractions, disruptions, tangential conversations

Negative emotions and fatigue

Graphical data display

EHR optimization

Tasks standardized

Work environment modification

Engaged and confident teachers

Sewell JL et al. *Teach Learn Med* 2019;41(3):256-279.

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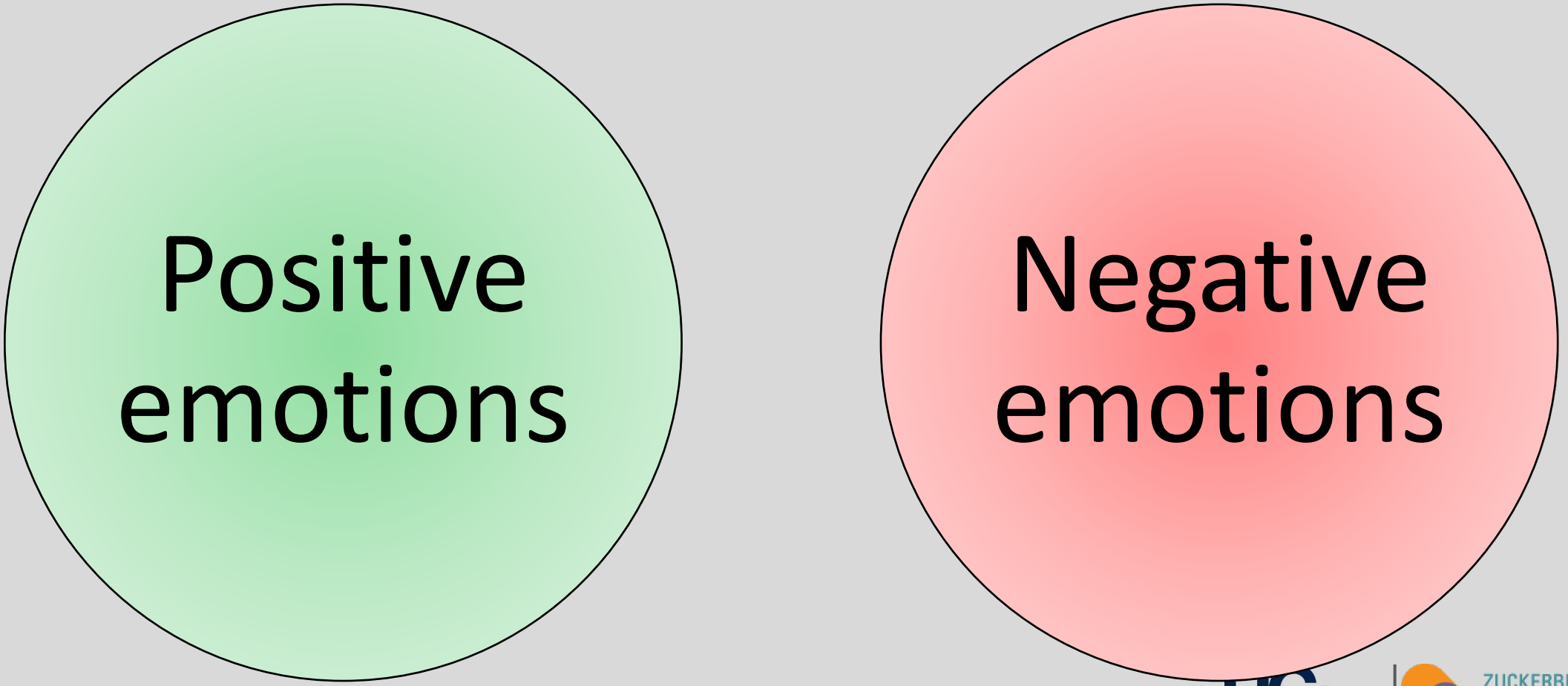
Emotions in workplace learning



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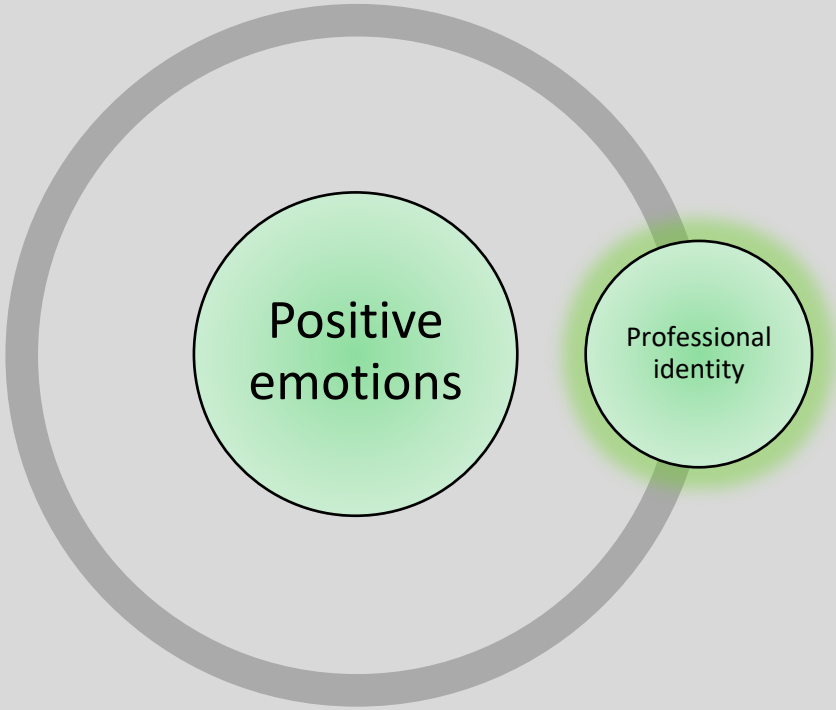

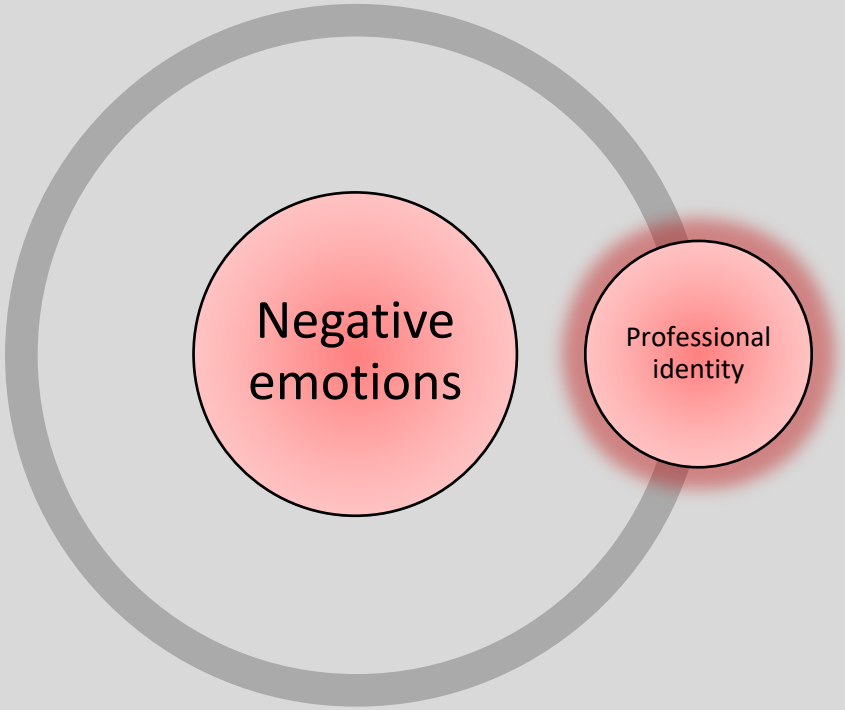

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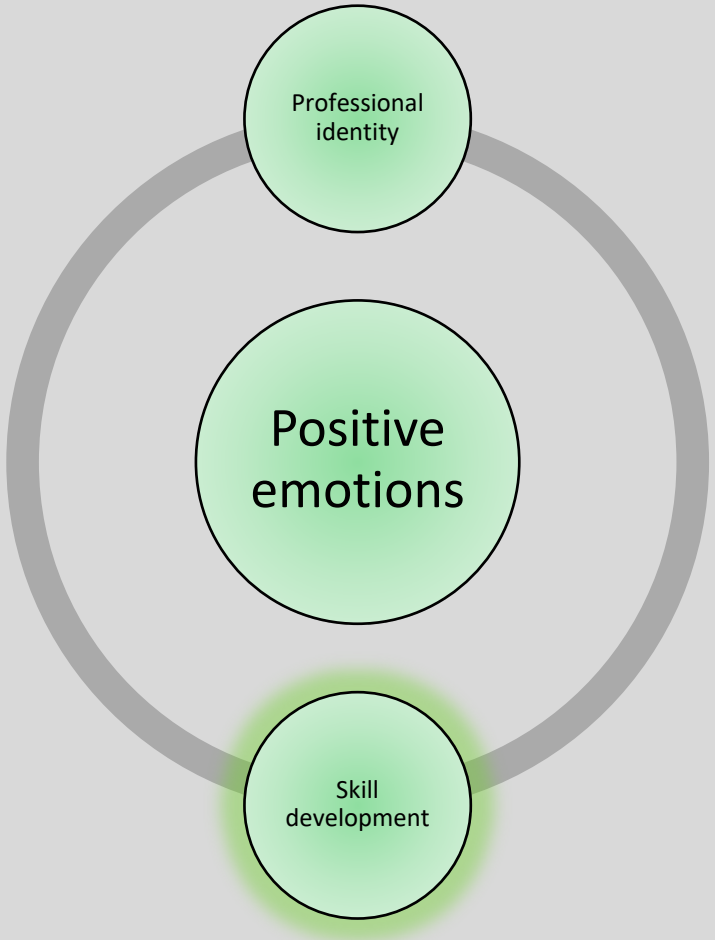

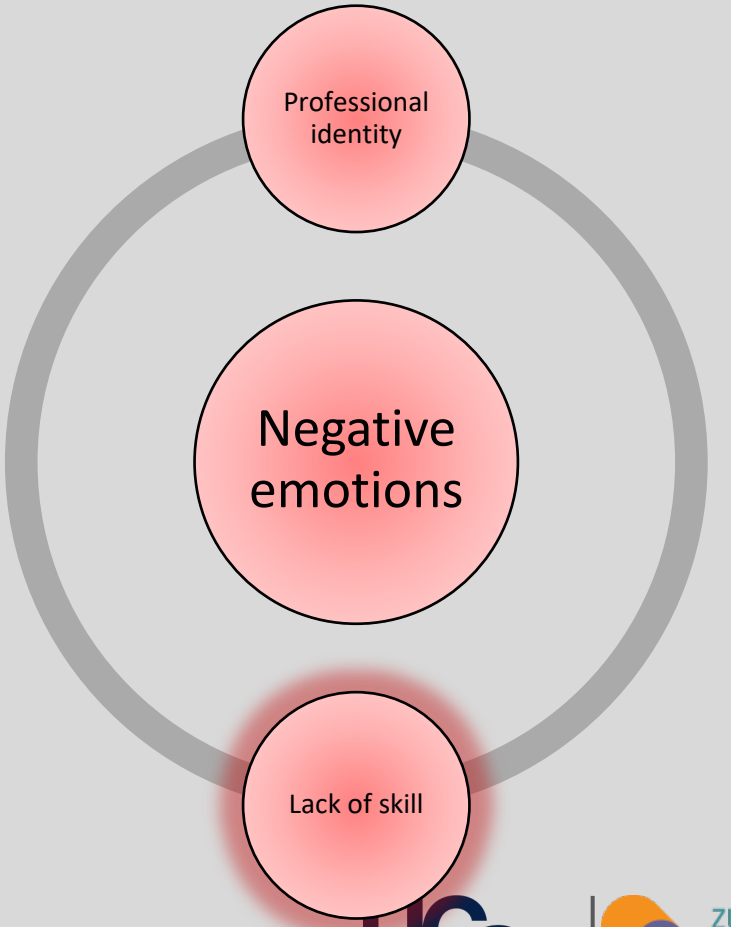

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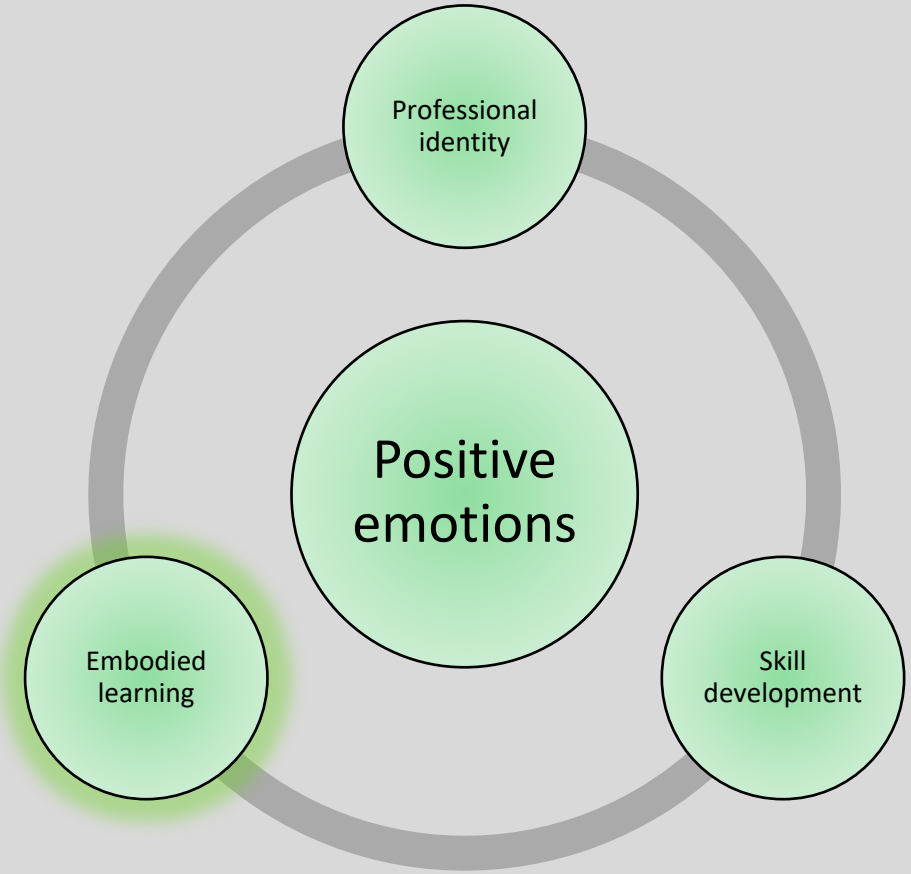

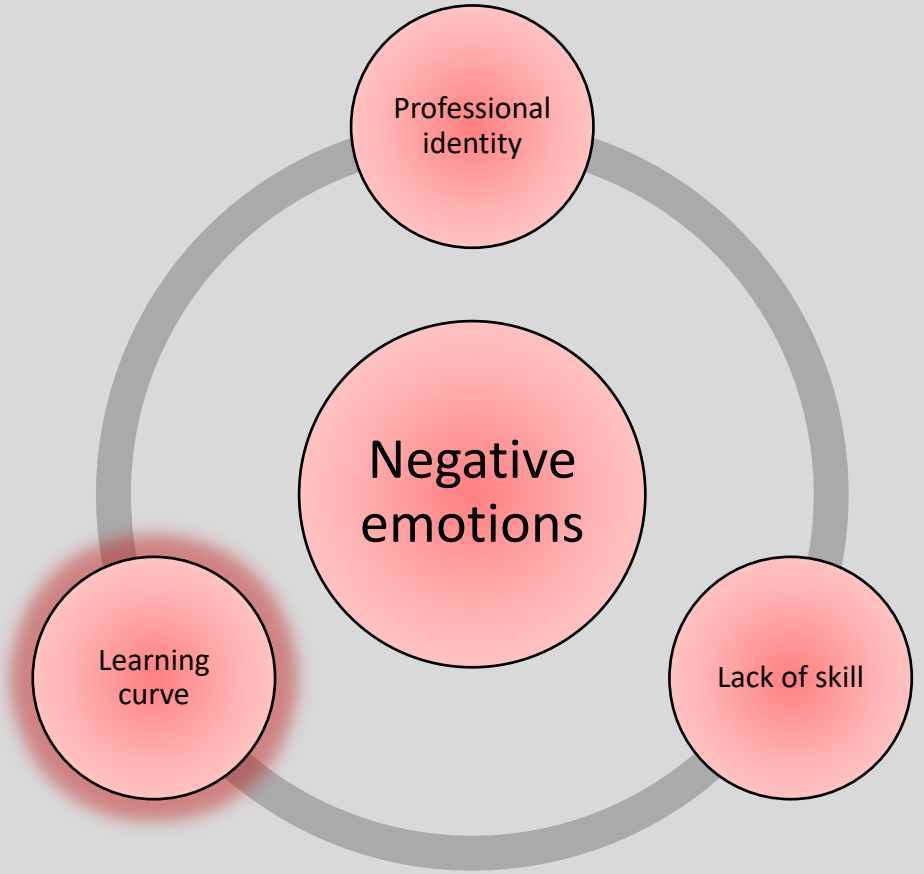

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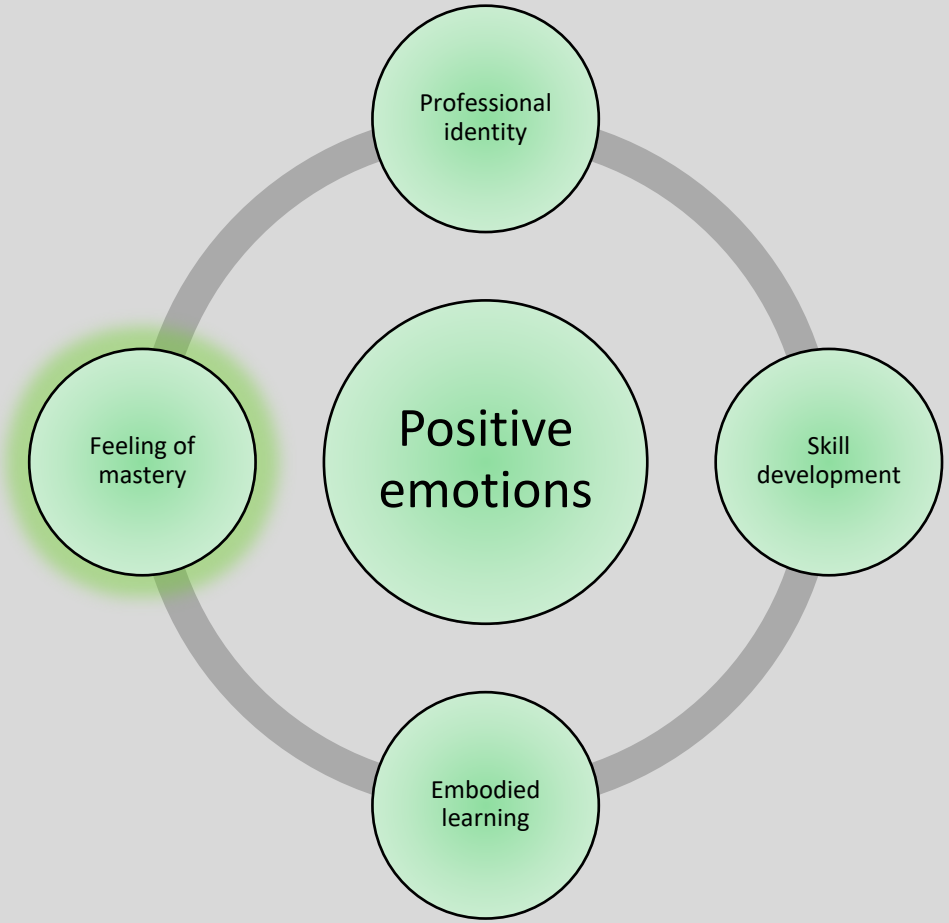

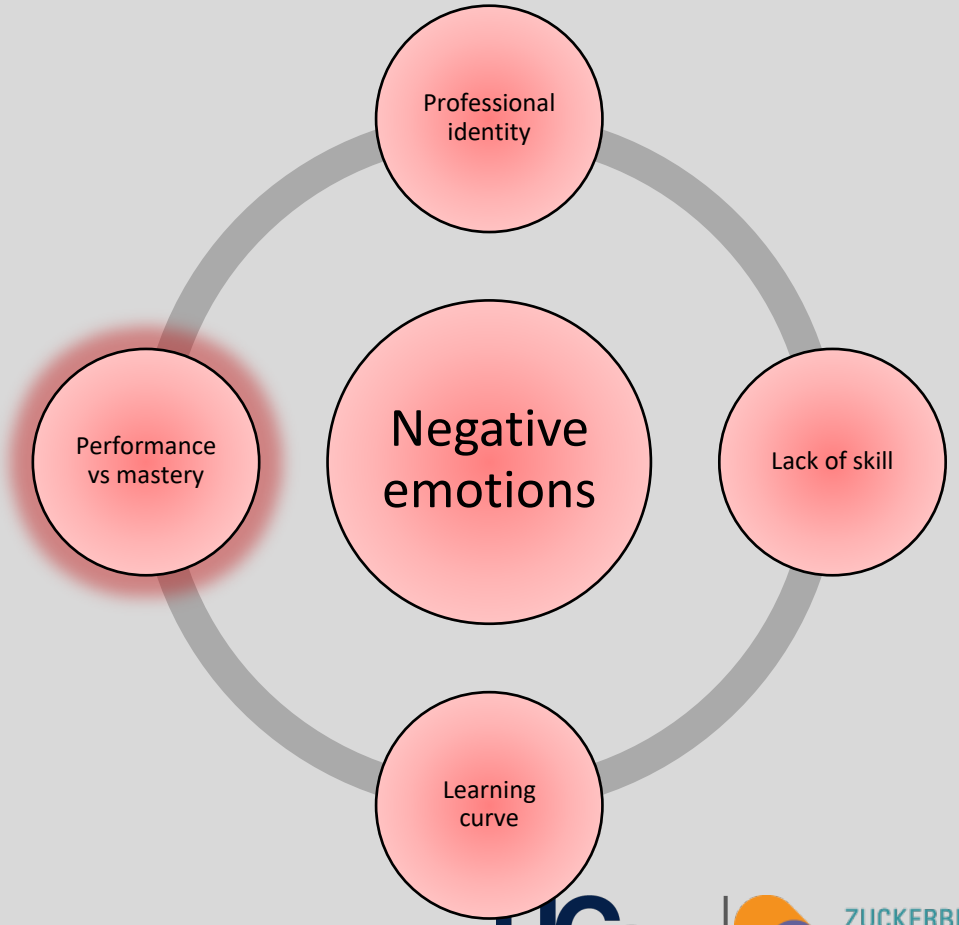

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Drivers of germane load in the workplace (schema formation and learning)

Strategies to Enhance Learning

- **Learner efforts**
- **Faculty efforts**
- **Design of practice**

- Self-explanation
- Teaching others
- Meta-cognition: concentration, anticipatory planning, monitoring, adapting, generalizing

- Interactive questioning
- Engagement with learners
- Feedback practices

- Mixed or random versus blocked practice

Must have space in WM!

Young JQ et al. *Teach Learn Med* 2016;28(1):88-96.
Sewell JL et al. *Teach Learn Med* 2019;41(3):256-279.

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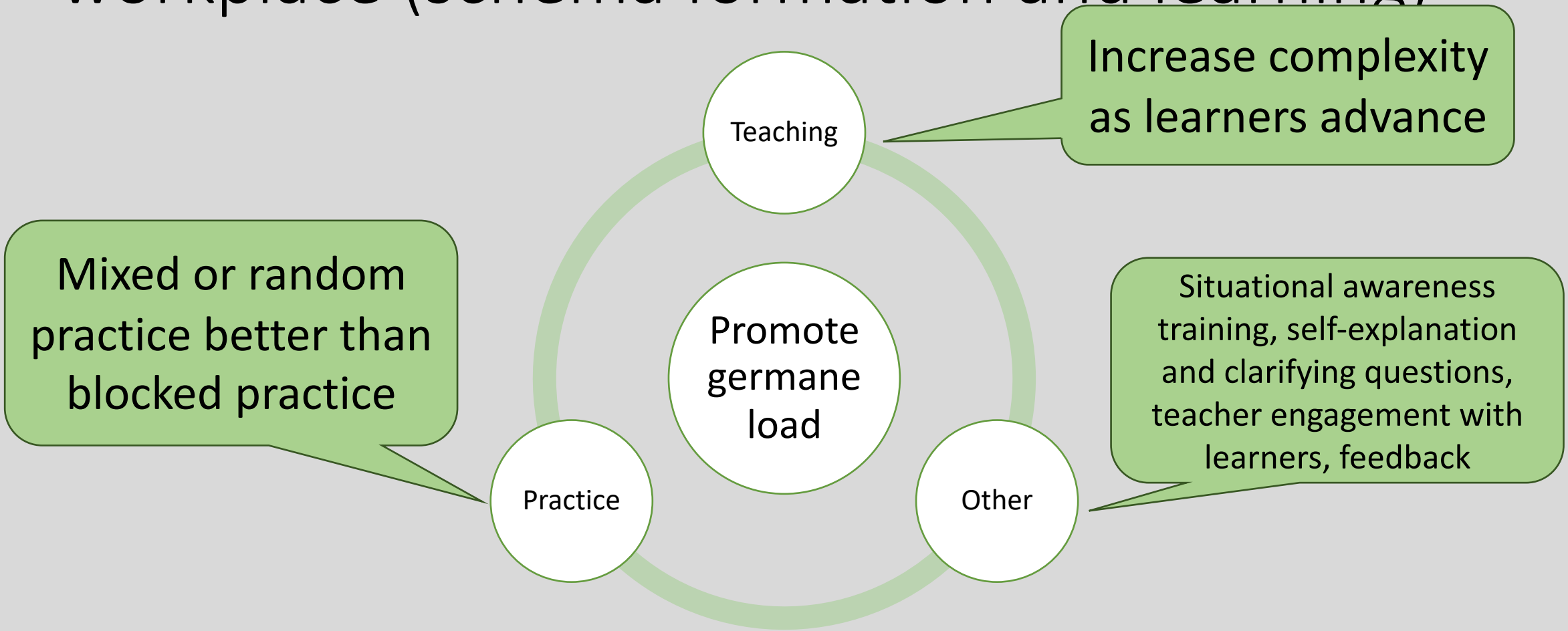

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How can we apply this in our own workplaces?

Photo by Ignacio Amenábar on Unsplash

How do we get from here…

To here?

Sewell JL et al. *Acad Med* 2019; Epub ahead of print.

Cognitive load in workplace

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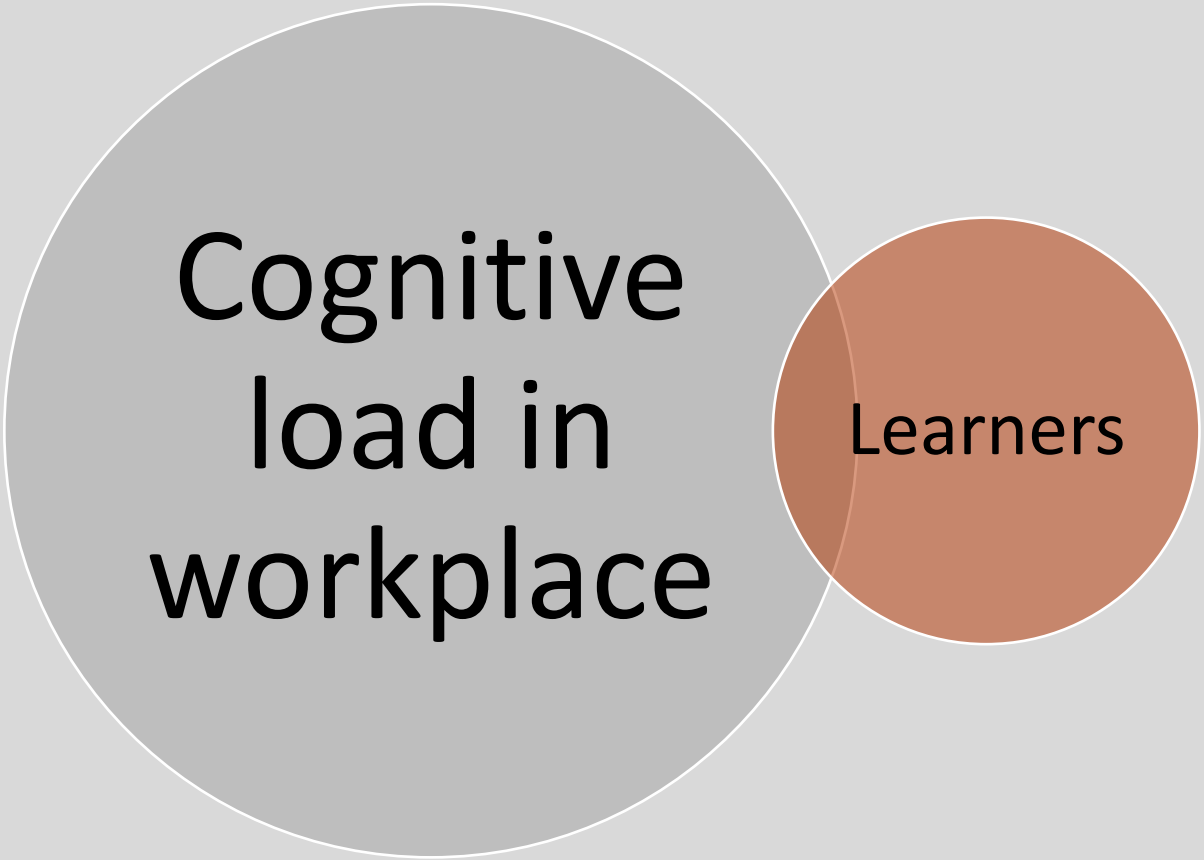
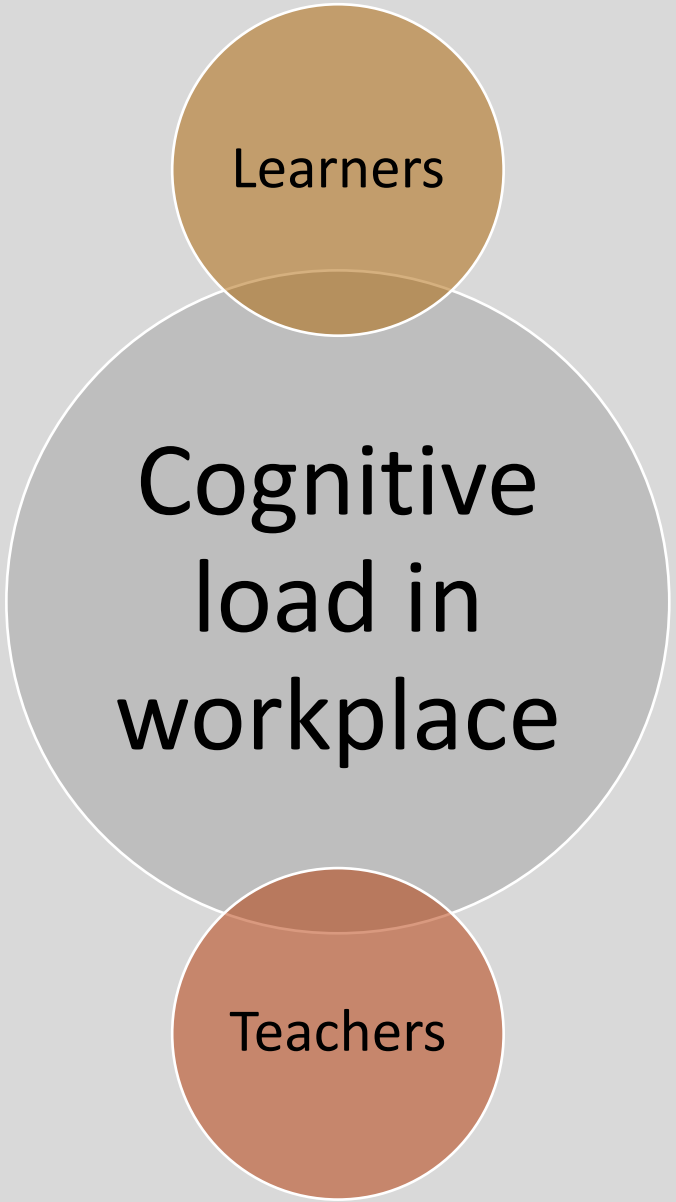
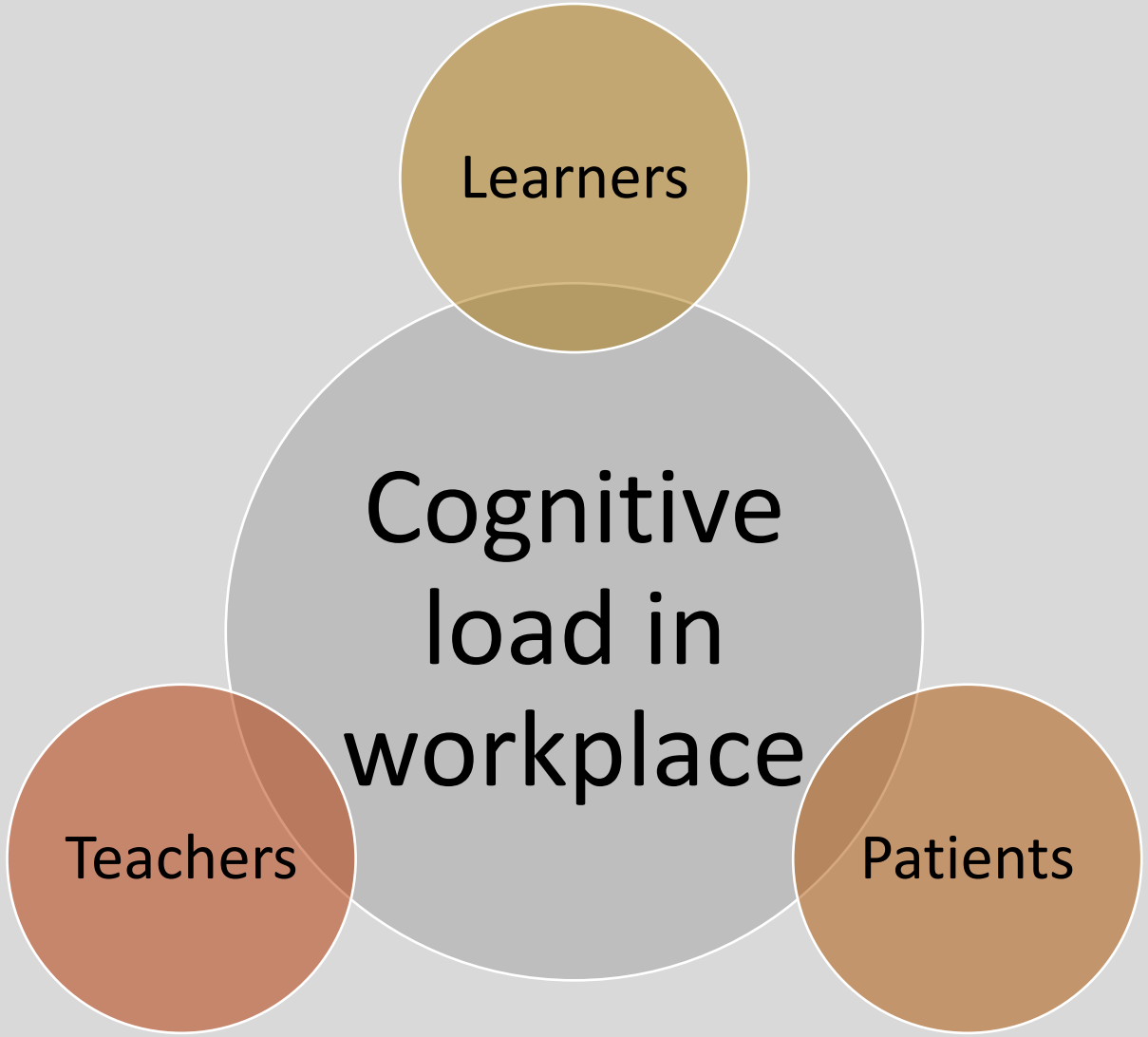
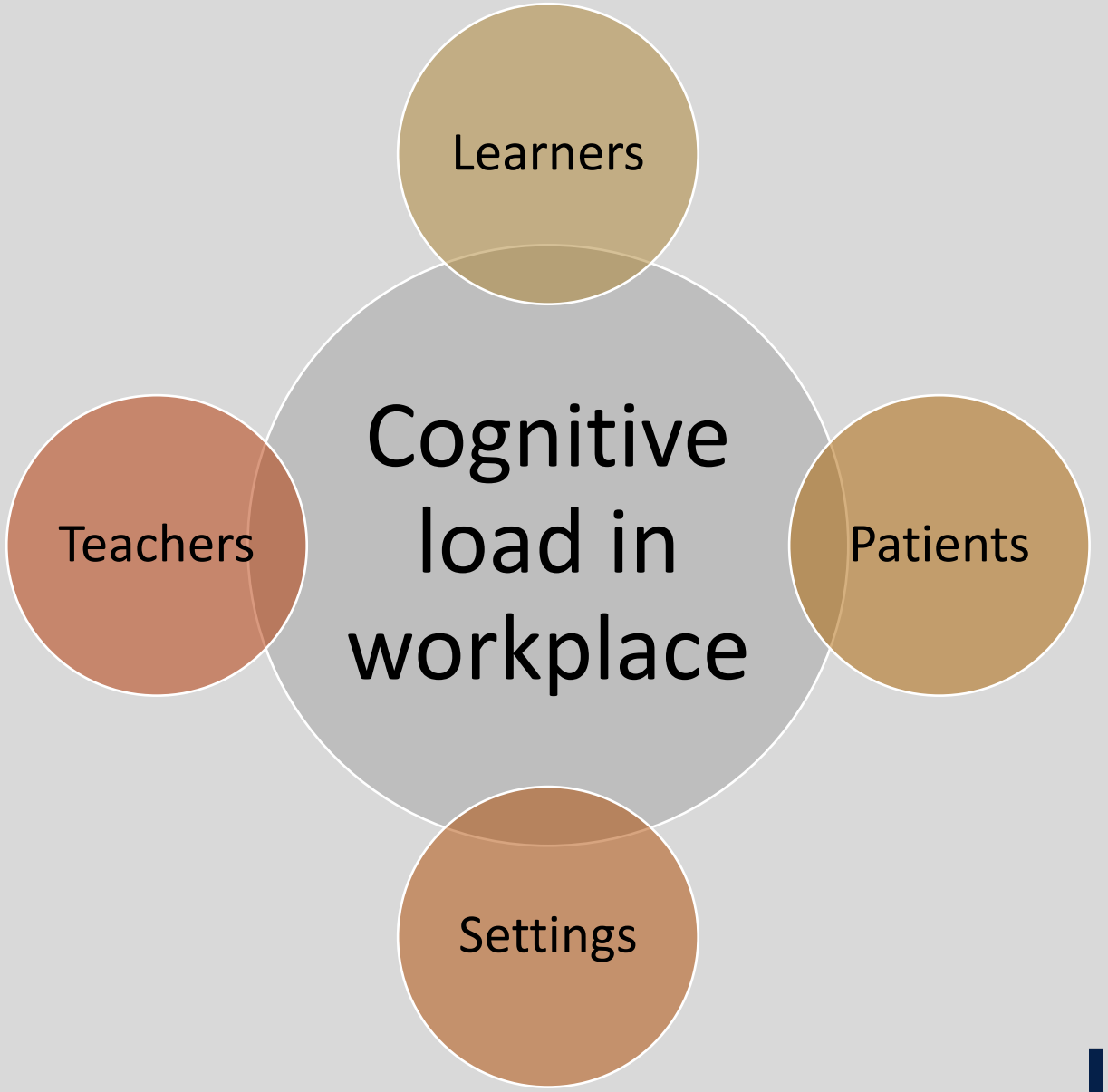

Cognitive load in workplace
Learners


Learners
Cognitive load in workplace
Teachers


Learners
Cognitive load in workplace
Teachers
Patients


Learners
Teachers
Cognitive load in workplace
Patients
Settings

Practical example: GI endoscopy

What contributes to cognitive load?

Cognitive load among 477 GI fellows

Intrinsic load was:	Germane load was:	Extraneous load was:
• **Higher:** fatigue, number maneuvers, supervisor takeover • **Lower:** year in training, prior colonoscopy experience, good patient tolerance	• **Higher:** more engaged supervisor, intrinsic load, extraneous load • **Lower:** none	• **Higher:** fatigue, queue order, supervisor takeover • **Lower:** more engaged supervisor, more confident supervisor

Sewell JL et al. *Acad Med* 2017;92:1622-1631.

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Cognitive load among 477 GI fellows

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Extraneous load was:

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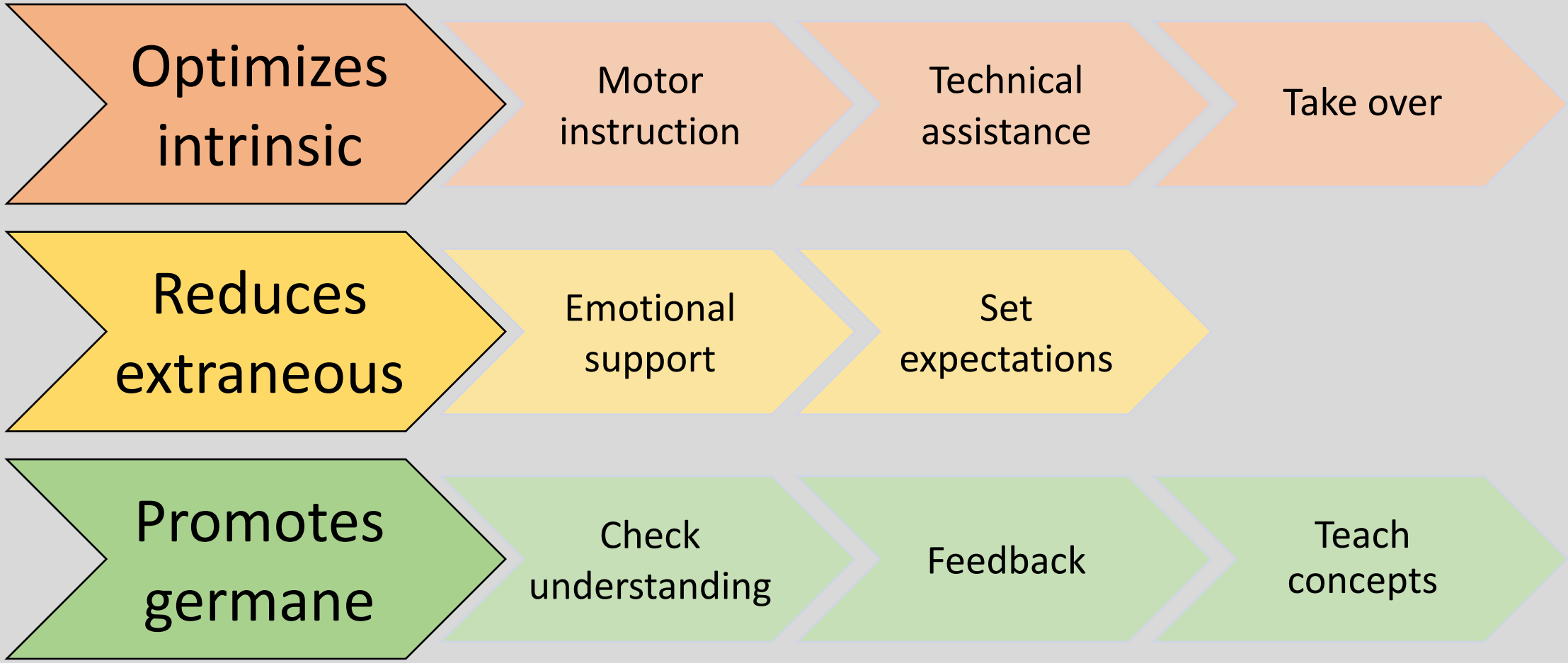
Practical example: GI endoscopy

How does teaching affect cognitive load?



Sewell JL et al. *Med Educ* 2019;53(9):925-940.

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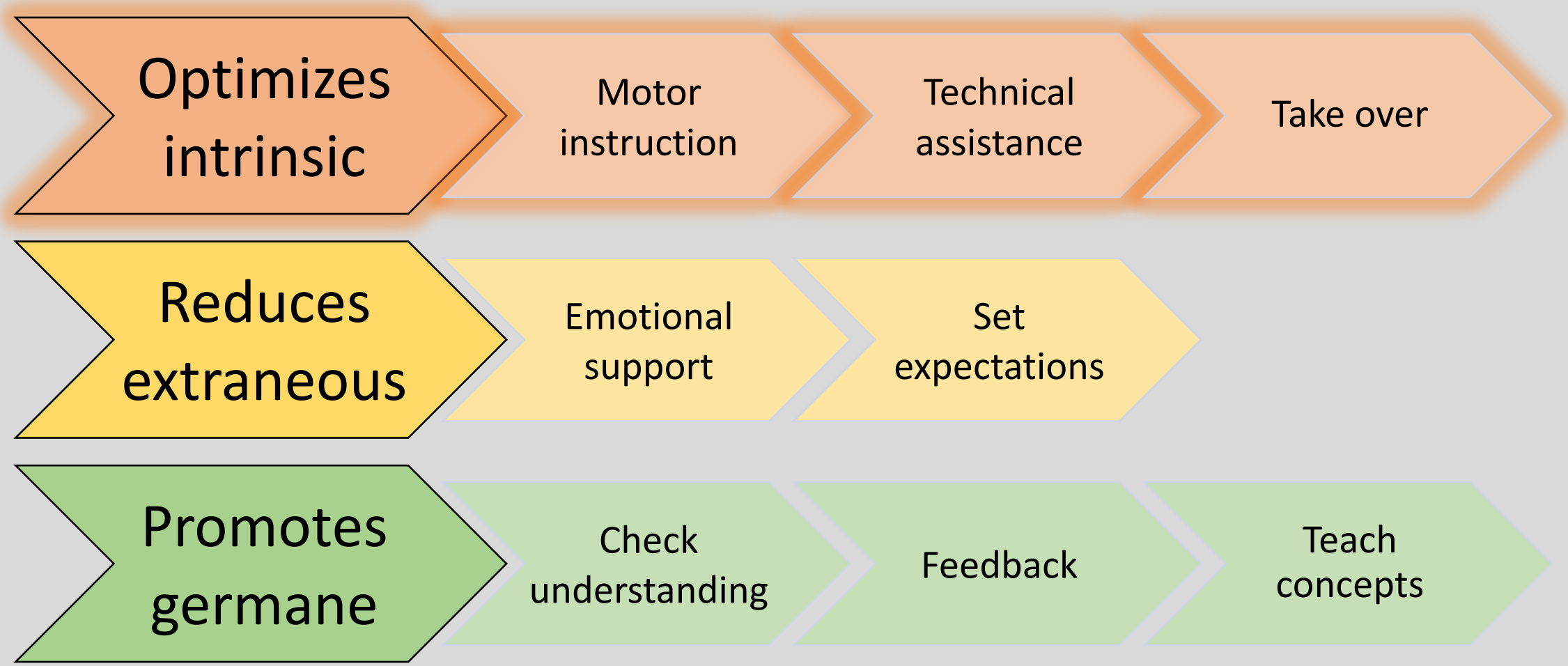

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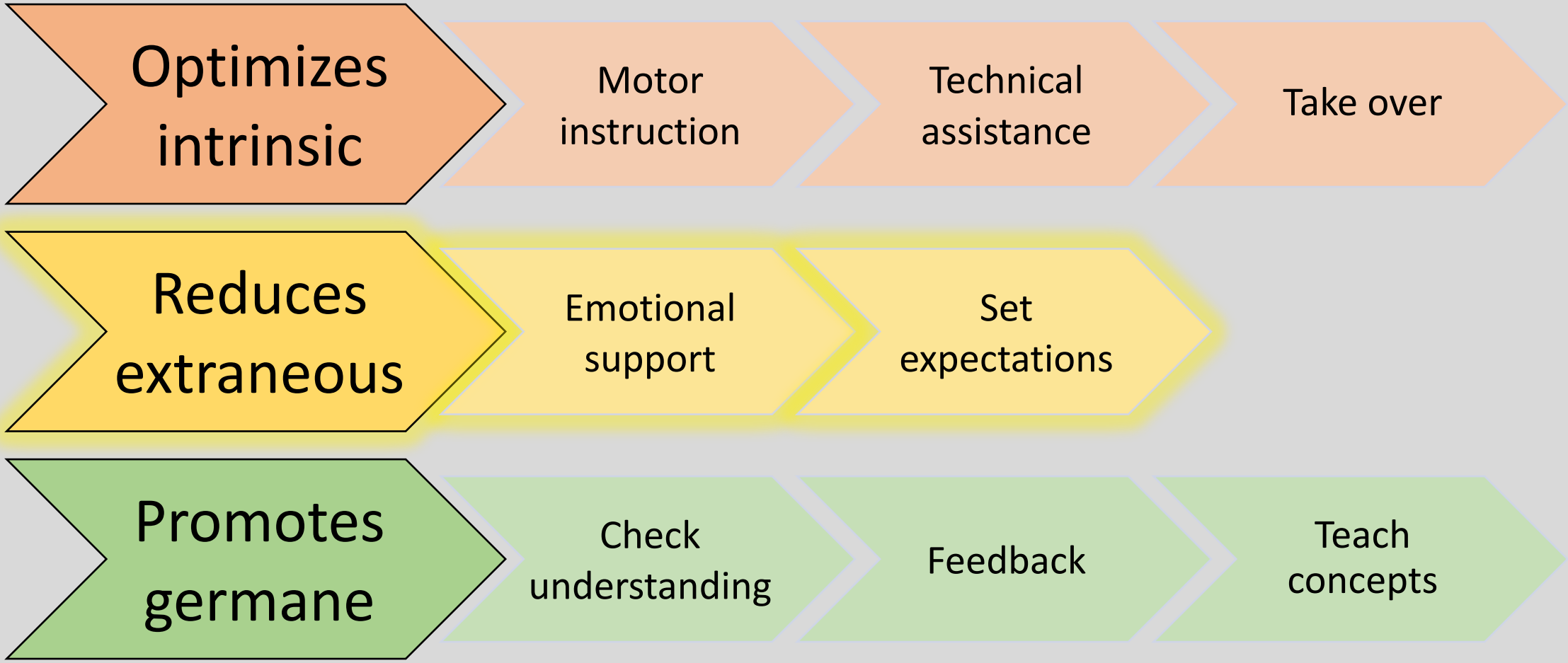

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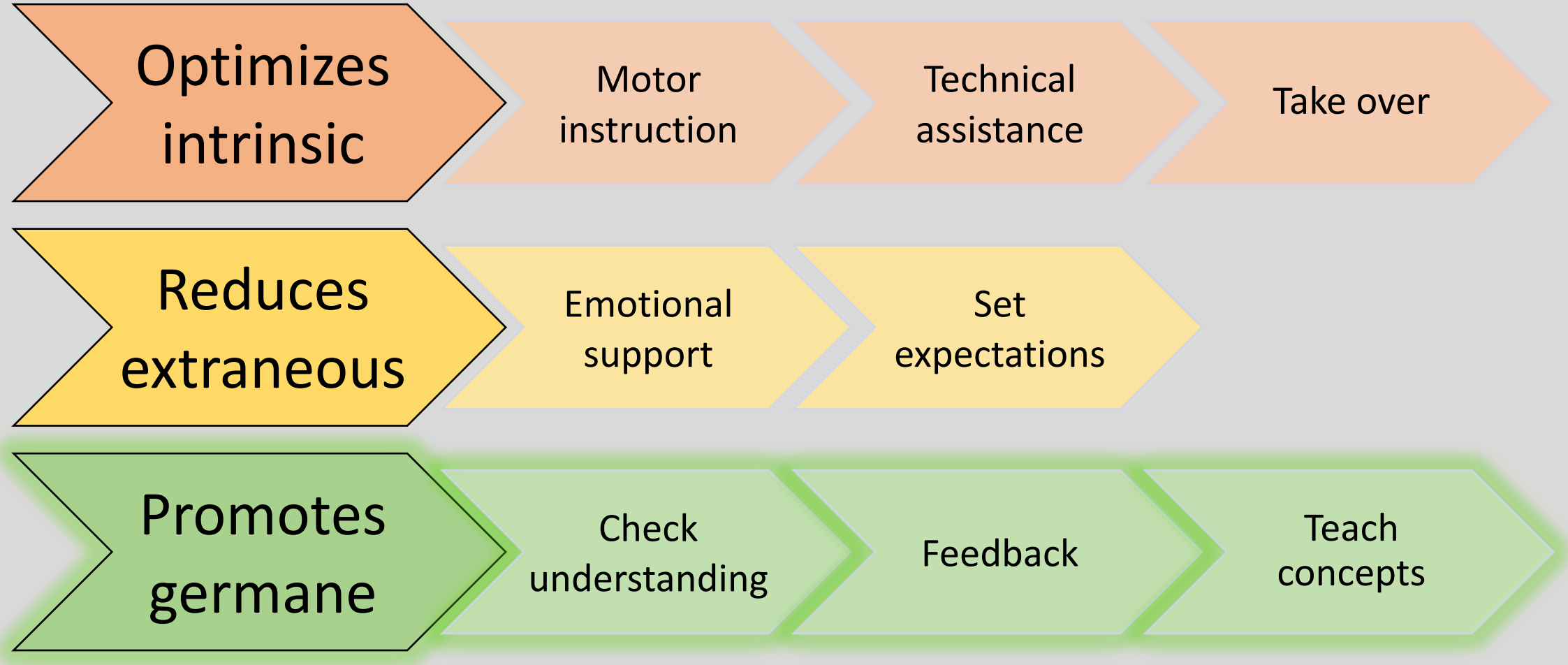

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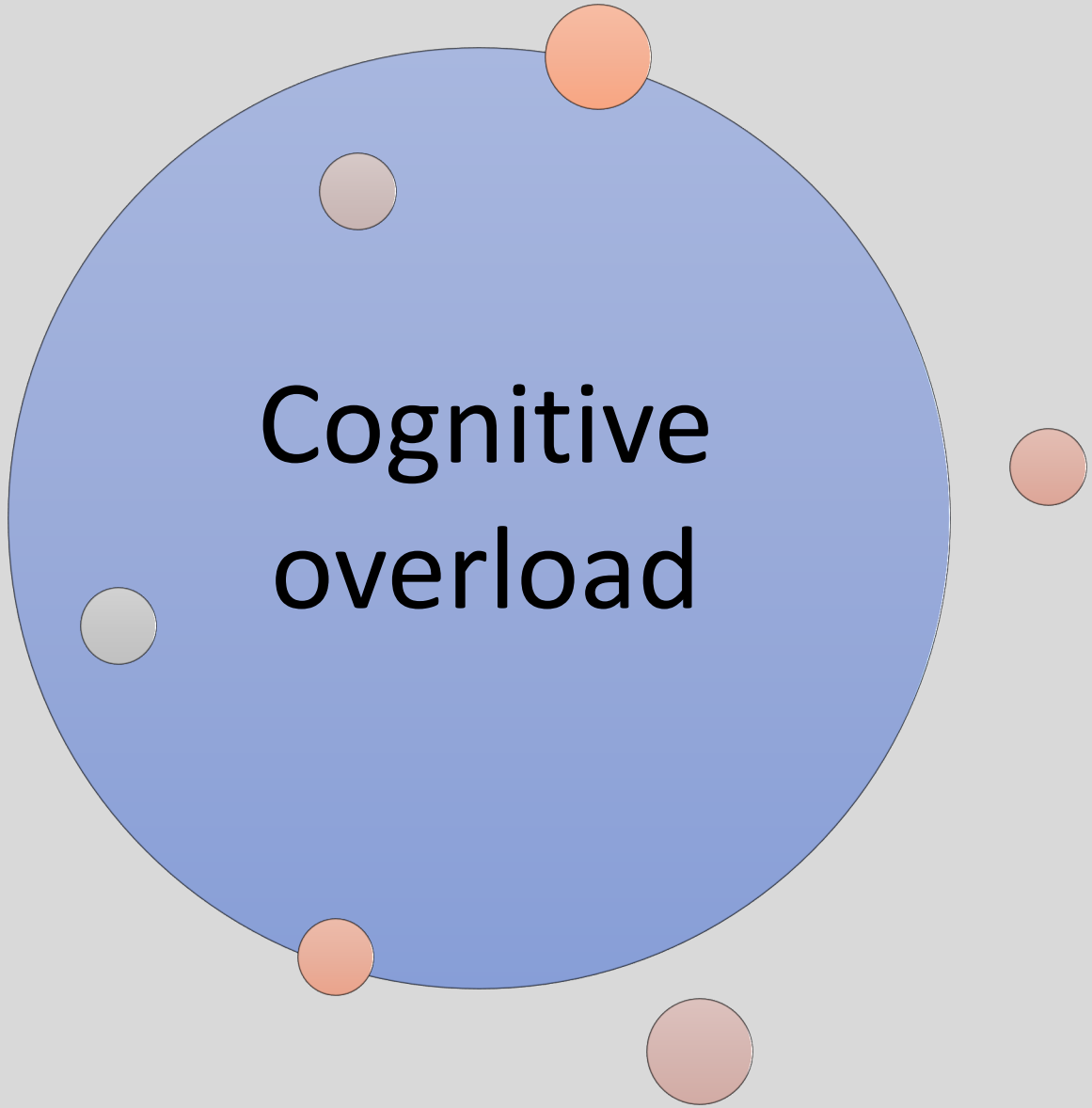
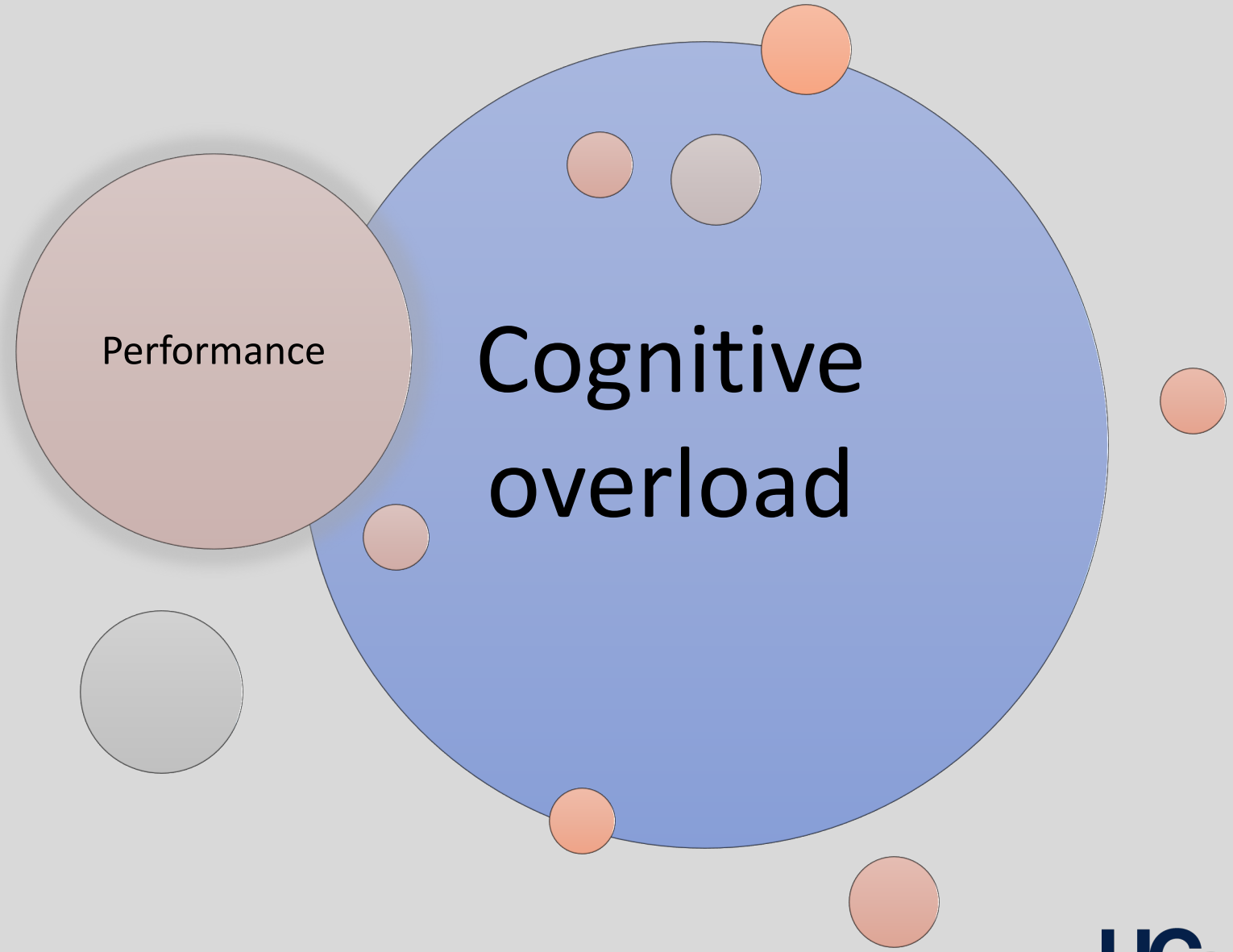
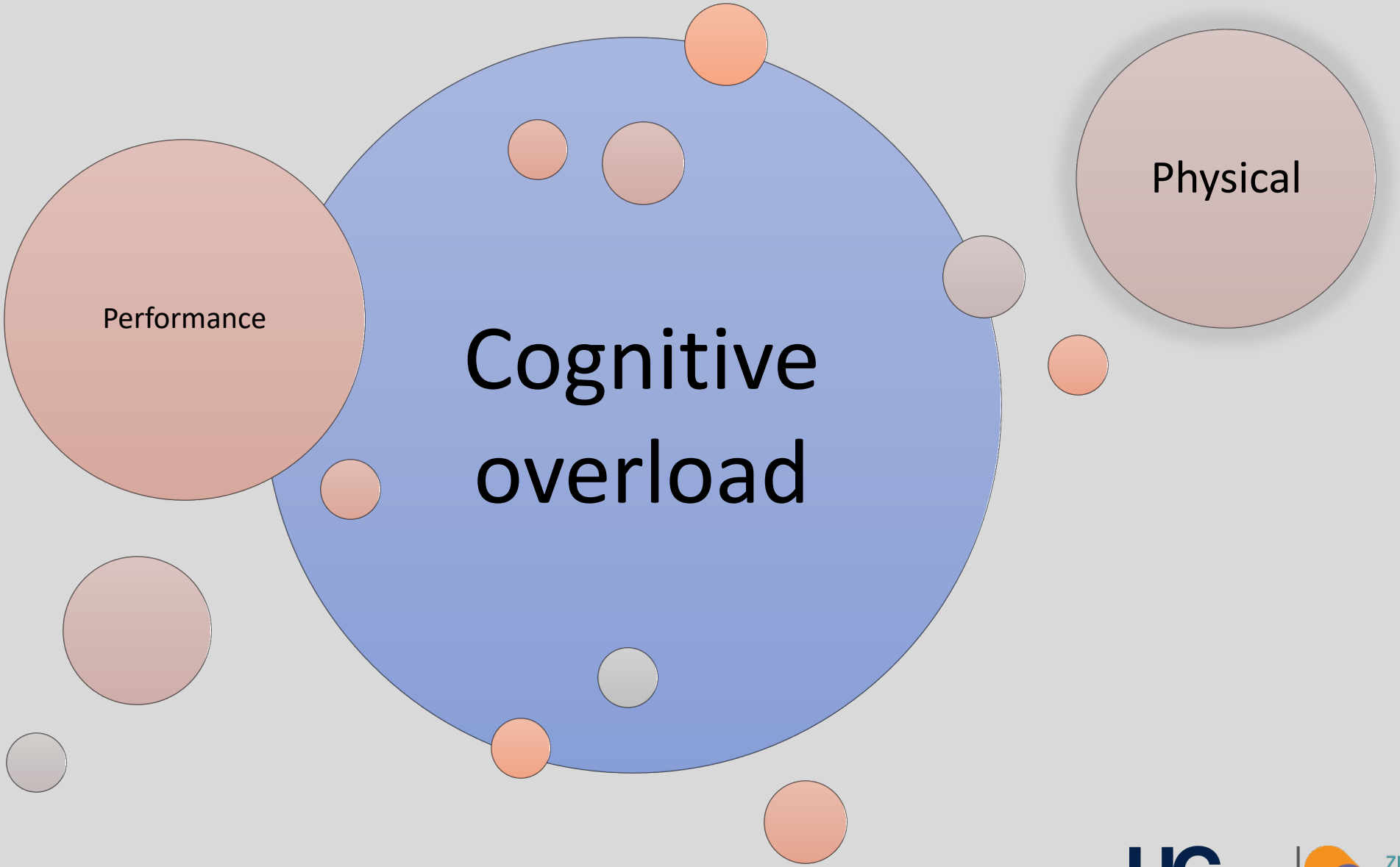
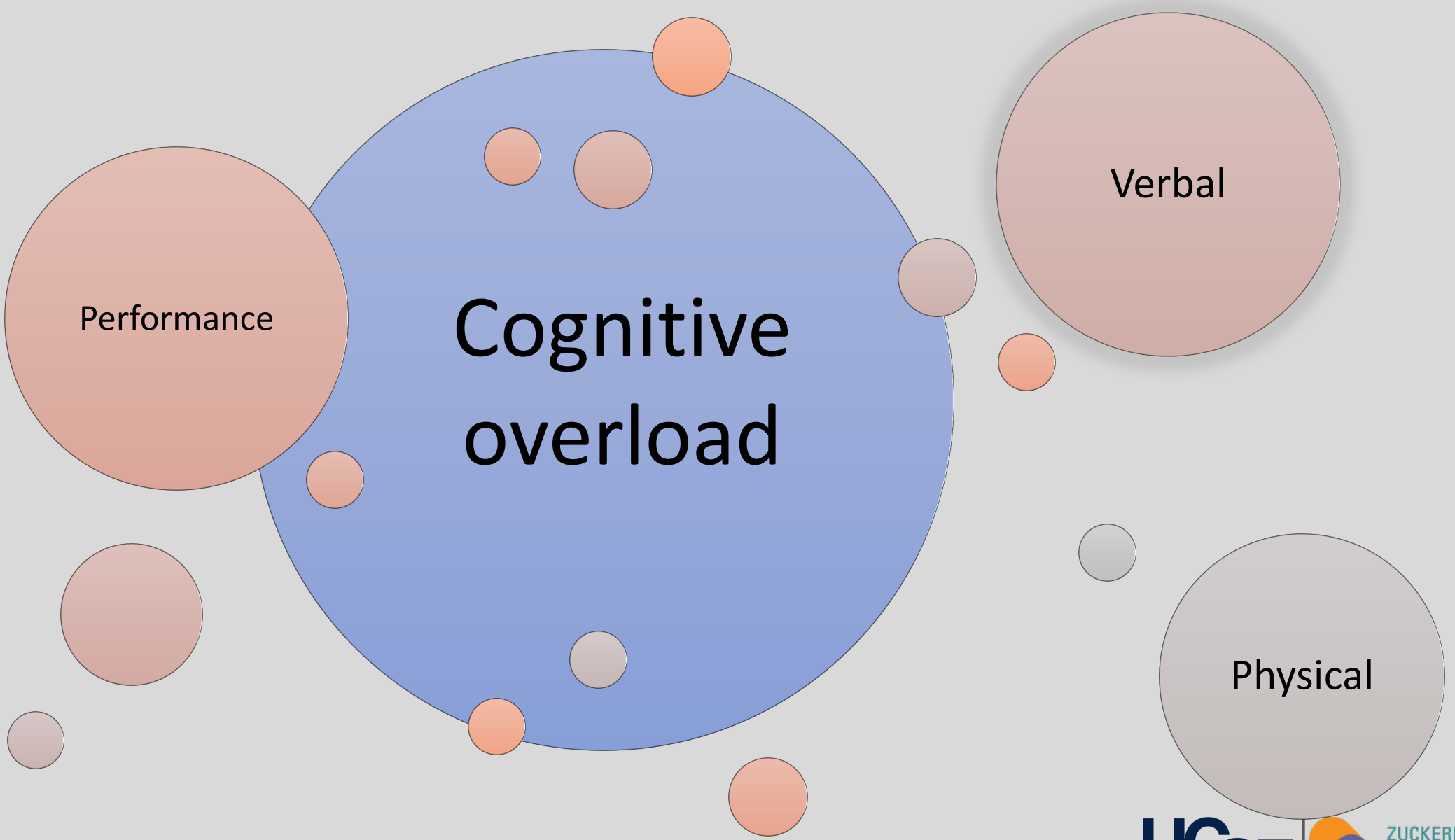

Cognitive
overload


Performance
Cognitive overload


Performance
Cognitive overload
Physical



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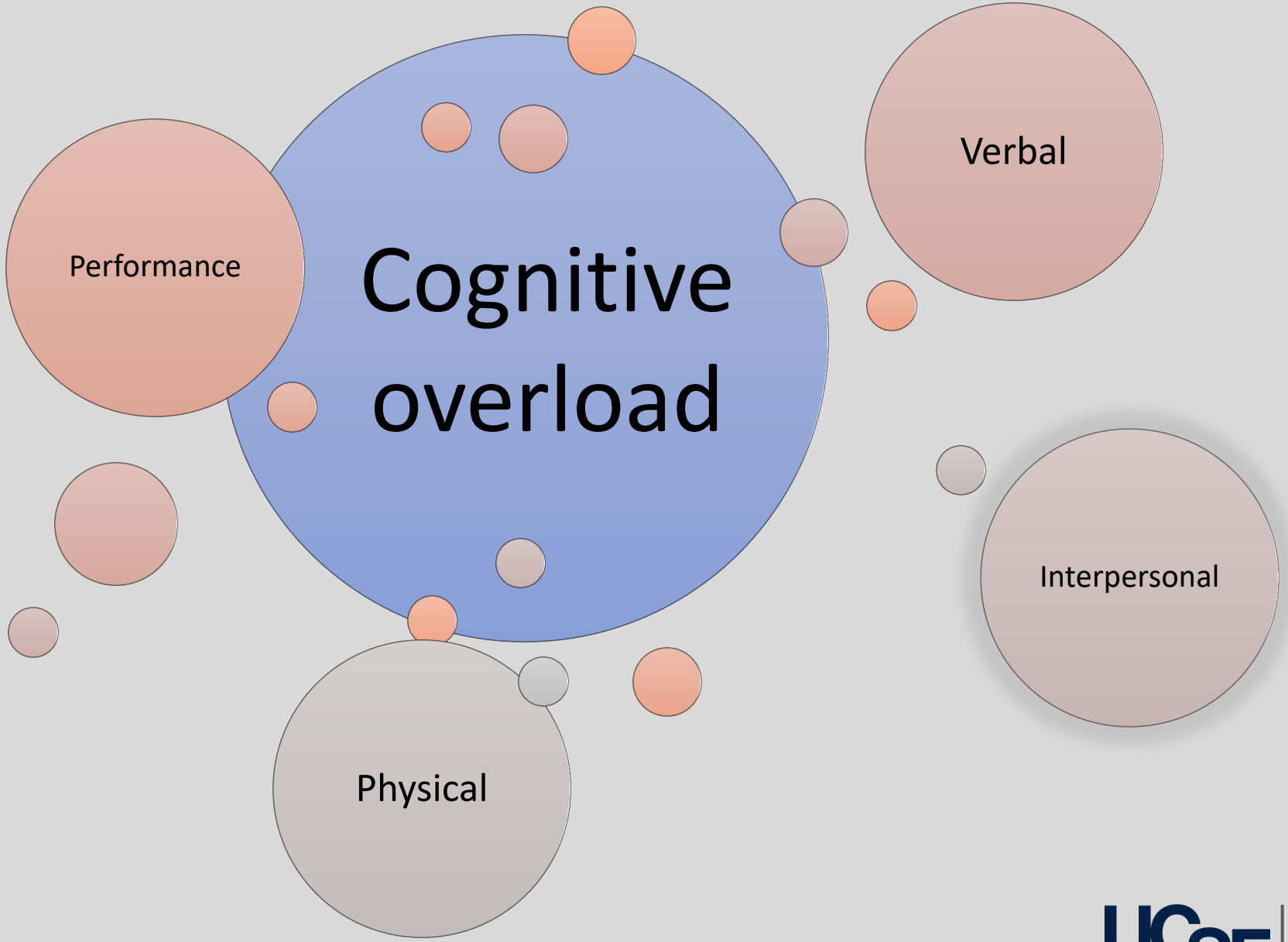

Performance
Cognitive overload
Verbal
Interpersonal
Physical

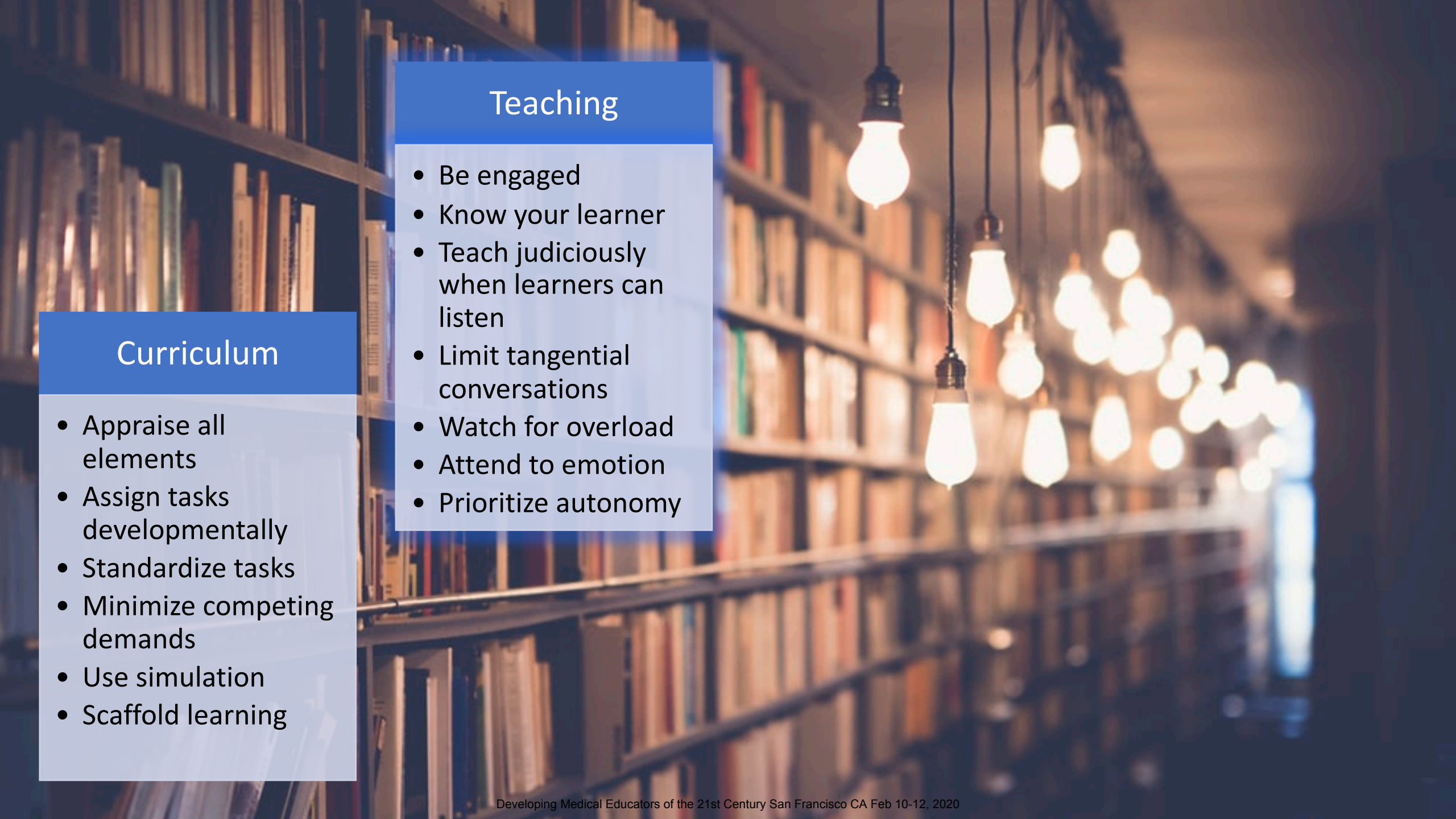
CLT Design Principles

Curriculum | Teaching
Environment | Metacognition

Photo by Janko Ferlič - @itfeelslikefilm on Unsplash

Curriculum

- Appraise all elements
- Assign tasks developmentally
- Standardize tasks
- Minimize competing demands
- Use simulation
- Scaffold learning



Curriculum

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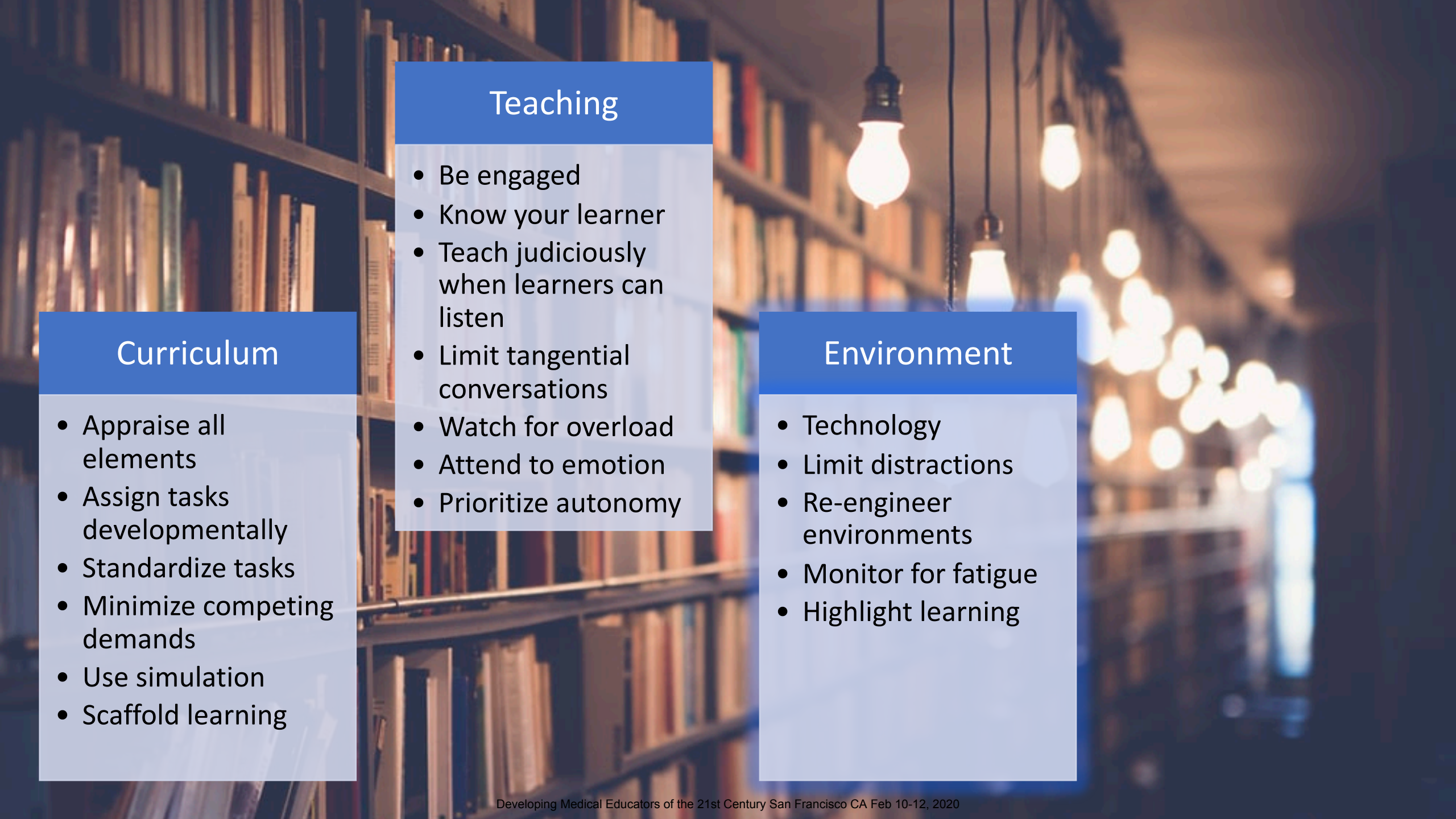
Teaching

- Be engaged
- Know your learner
- Teach judiciously when learners can listen
- Limit tangential conversations
- Watch for overload
- Attend to emotion
- Prioritize autonomy



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Environment

- Technology
- Limit distractions
- Re-engineer environments
- Monitor for fatigue
- Highlight learning

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Metacognition

- Provide strategies
- Help learners know where to focus mental effort
- Teach about cognitive load
- Monitor for overload

Wrap-up

Pair up with someone sitting near to you. Discuss for two minutes how you could use CLT in your workplace teaching.

Summary

- Cognitive load theory provides a specific theoretical lens highly relevant to health professions workplace learning
- If we match intrinsic load (task difficulty) to learner experience, minimize extraneous load (unproductive processing) and provide strategies to promote germane load (schema formation), we will improve learning!
- Small practical steps can benefit learner cognitive load
- CLT can dovetail with other learning theories
- Teaching teachers and learners about CLT may help!

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Thank you!

justin.sewell@ucsf.edu

Twitter @GIMedEd

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