Application of the Learning Sciences

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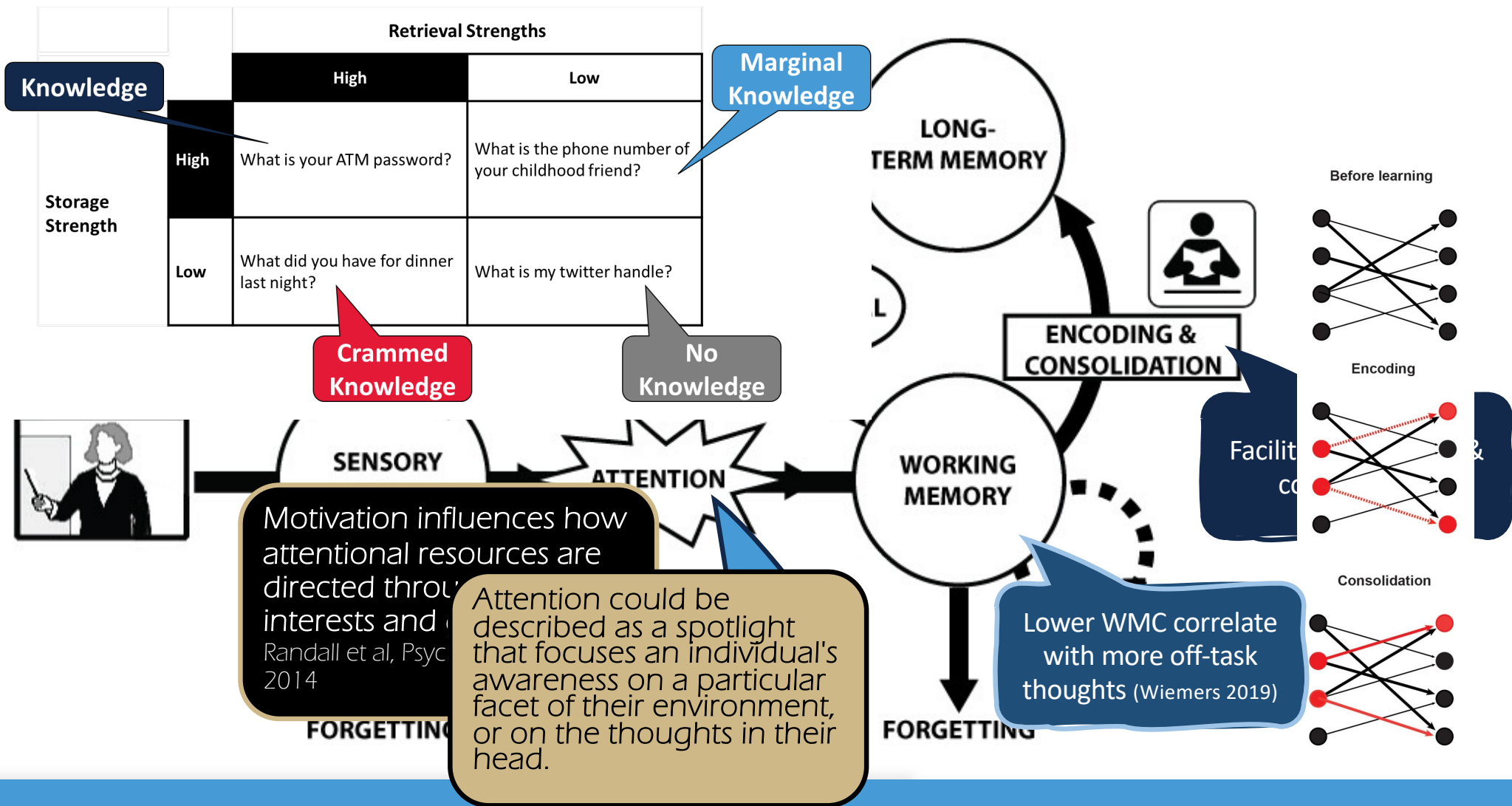
@AdamPersky

Learning Defined

The ability to acquire new information and skills and retrieve that information or skill to apply it to a future problem

- **Retention:** ability to use information after significant periods of disuse
- **Transfer:** use the information to solve problems that arise in a context different (if only slightly) from the context in which the information was originally taught

How we learn

And what to do about it

Retrieval Strengths

		High	Low
Storage Strength	High	What is your ATM password?	What is the phone number of your childhood friend?
	Low	What did you have for dinner last night?	What is my twitter handle?

Knowledge

Marginal Knowledge

Crammed Knowledge

No Knowledge

LONG-TERM MEMORY

ENCODING & CONSOLIDATION

SENSORY

ATTENTION

WORKING MEMORY

FORGETTING

FORGETTING

Before learning

Encoding

Consolidation

Facilit... co...

Motivation influences how attentional resources are directed throu... interests and... Randall et al, Psyc... 2014

Attention could be described as a spotlight that focuses an individual's awareness on a particular facet of their environment, or on the thoughts in their head.

Lower WMC correlate with more off-task thoughts (Wiemers 2019)

Attention & Motivation: **Teaching Practices**

Task Traits

- Complexity & length
- Int
- Re
- N
- Sc

Activ

- Provi
- Perceived choice

- Discussion / P2P teaching
- Assess baseline

Inclusive environment & Classroom rules

> **Although mind-wandering during task completion is associated with performance decrements, task related thoughts are associated with enhanced performance**
>
> **Active learning helps with task related thoughts. It is not how long it takes but what you are thinking about while doing it.**

Encoding and Consolidation: Teaching Practices

Memory/Fluency
- Spacing
- Scaffolding

Induction/Refinement
- Pretraining
- Worked example

Sense-Making/Understanding
- Comparison

To build on task-related thoughts, activities should help: elaborate, provide distinctiveness, making learning personal, and have it applied to real problems

- Interleaving
- Application
- variability

- Interest

Retrieval and Accessibility: **Teaching Practices**

Quizzes (ungraded or low stakes)

Questions

Classroom Assessment Techniques

Clickers

Writing assignments

Collaborative learning / Discussion

Cases

Reflection

Applying Theory to Practice

Instructional Alignment

- Construct lesson objectives

Instructional alignment routinely causes effect sizes exceeding *1 and 2 two sigma*, about *four times* what we ordinarily see in typical classrooms.

Cohen, Educ Res 1987

Instructional Delivery

- What methods will you use to help students achieve the learning goals
- Do they match the learning goals?

Learning Objectives (Workplace activities)

Entrustable Professional Activity (EPA)

- Tasks or responsibilities that trainees are entrusted to perform unsupervised once they have attained sufficient specific competence.

- Independently executable, observable, and measurable in their process and outcome

- Self-contained activity that the typical health professions educator may be expected to perform in the context of his/her professional role
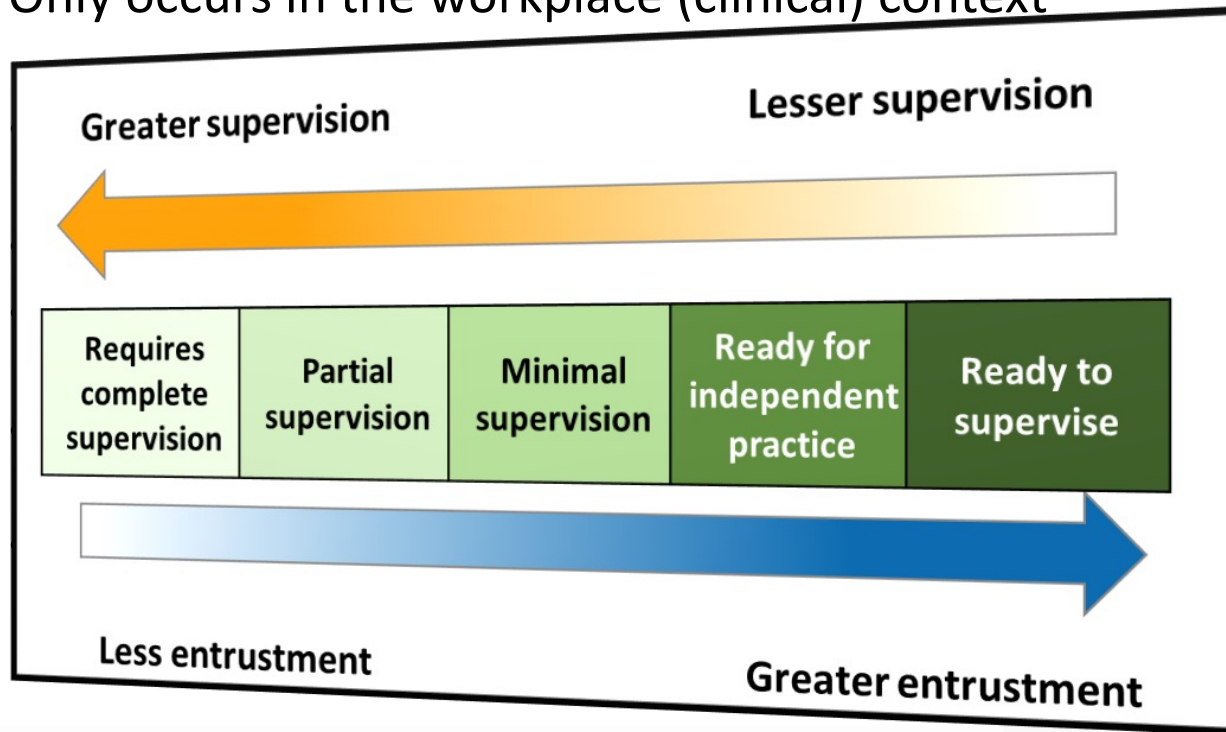
Learning Goals

Assessment

Instructional Delivery

Cate OT, Hoff RG. The Clinical Teacher 2017 Dec; 14 (6):385-389

Cate OT, Schwartz A, Chen HC. Academic Med 2020 Nov; 95 (11): 1662-1669

Cate OT, Carraccio C, Damodaran A, et al. Academic Med. 2021 Feb 1;96(2):199-204

Advancing Medicine for Life

Entrustable Professional Activity

Making an entrustment decision

Only occurs in the workplace (clinical) context
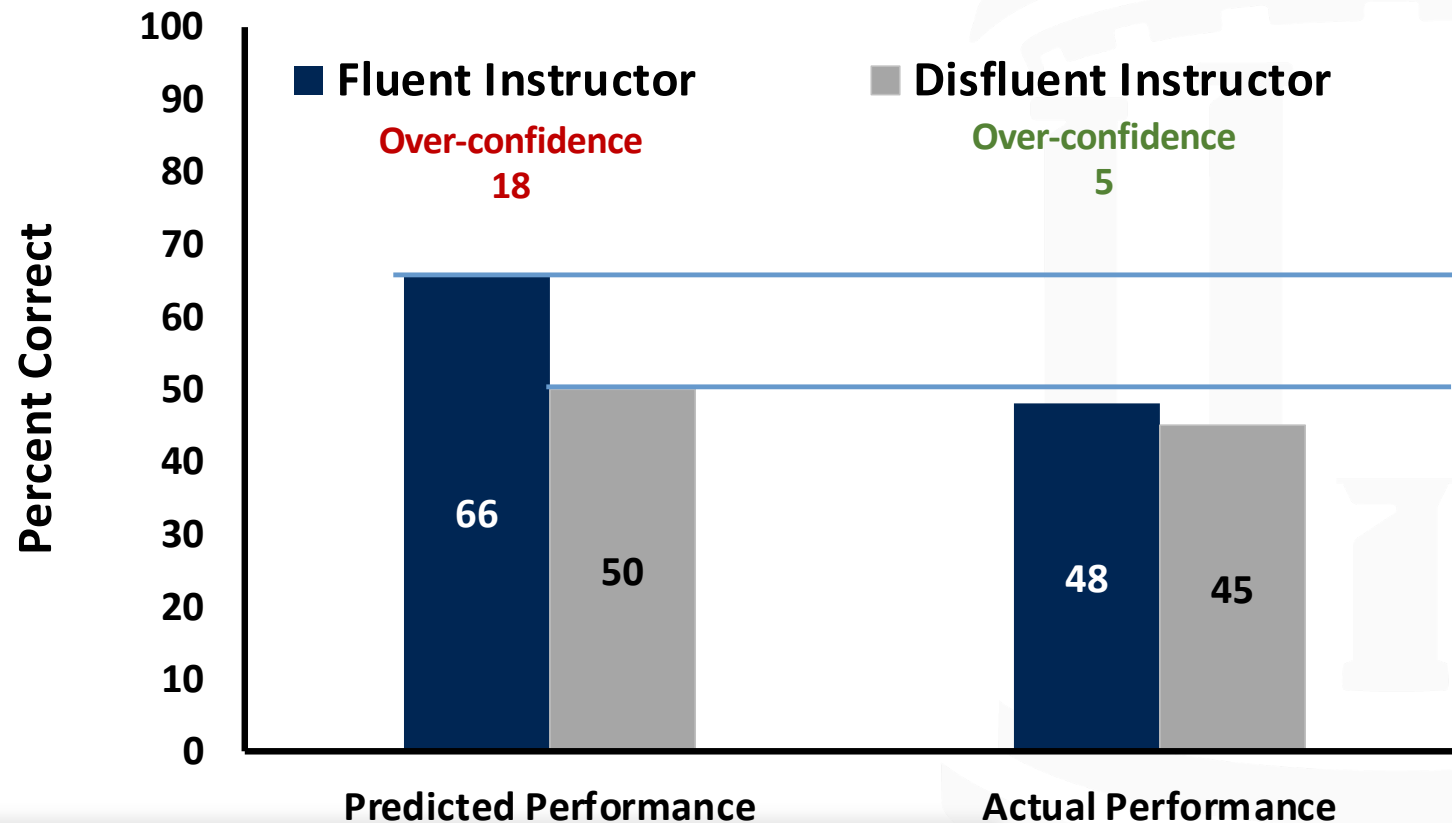

Ten Cate and Chen, Med Teach, 2020

Approaches to Assessment

Holistic vs Analytic

- Holistic (or Global) Grading
  - Evaluator builds a mental model of the student work, allowing for an appreciation of the quality of work as a whole.
  - Qualitative judgement along with a rationale that is based on one or more criteria

- Analytic
  - Evaluator makes separate qualitative judgements on a set of pre-determined criteria (e.g., rubric categories)
  - Separate judgements are converted to a grade.

Why is assessment important?

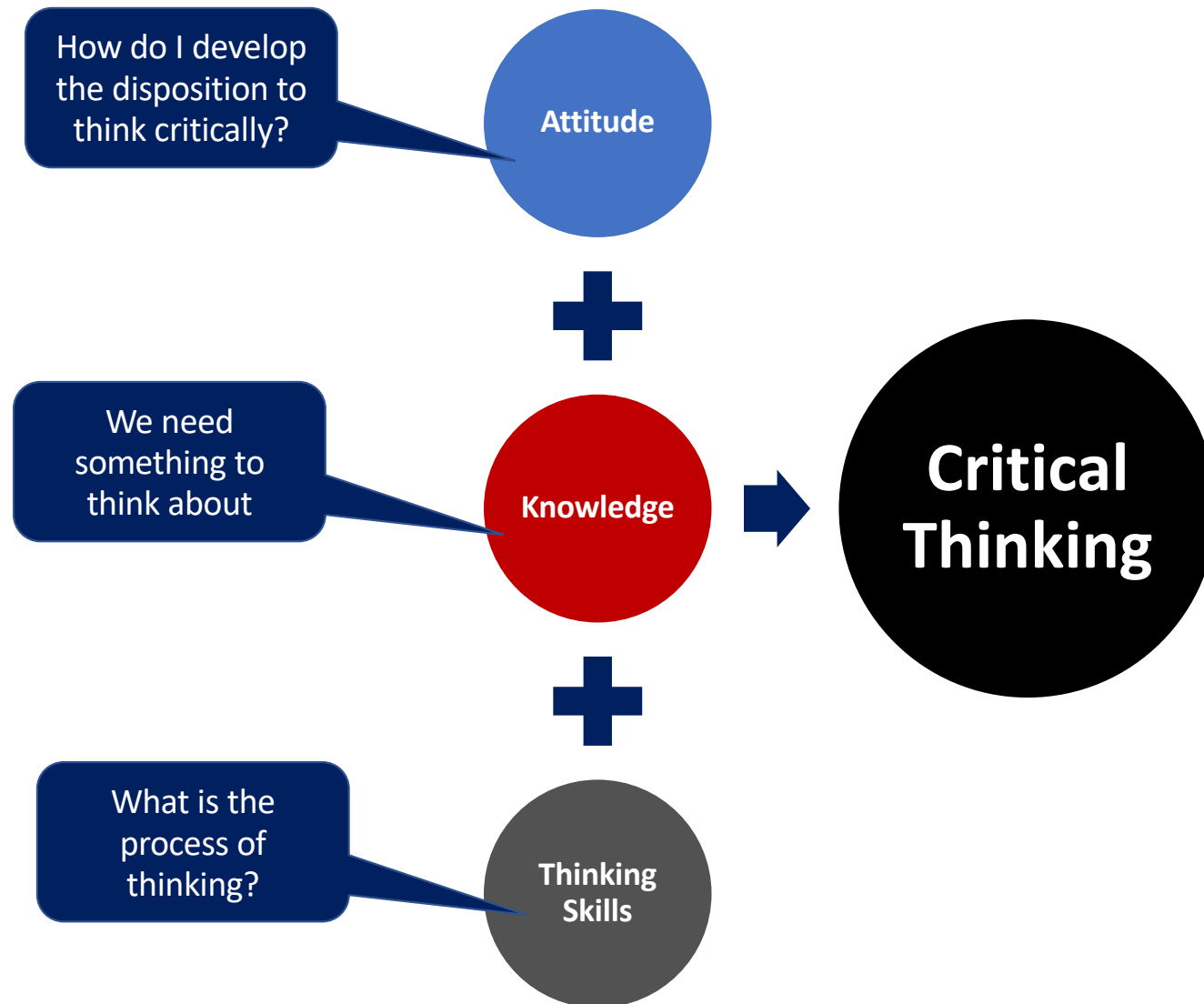Easy of fluency

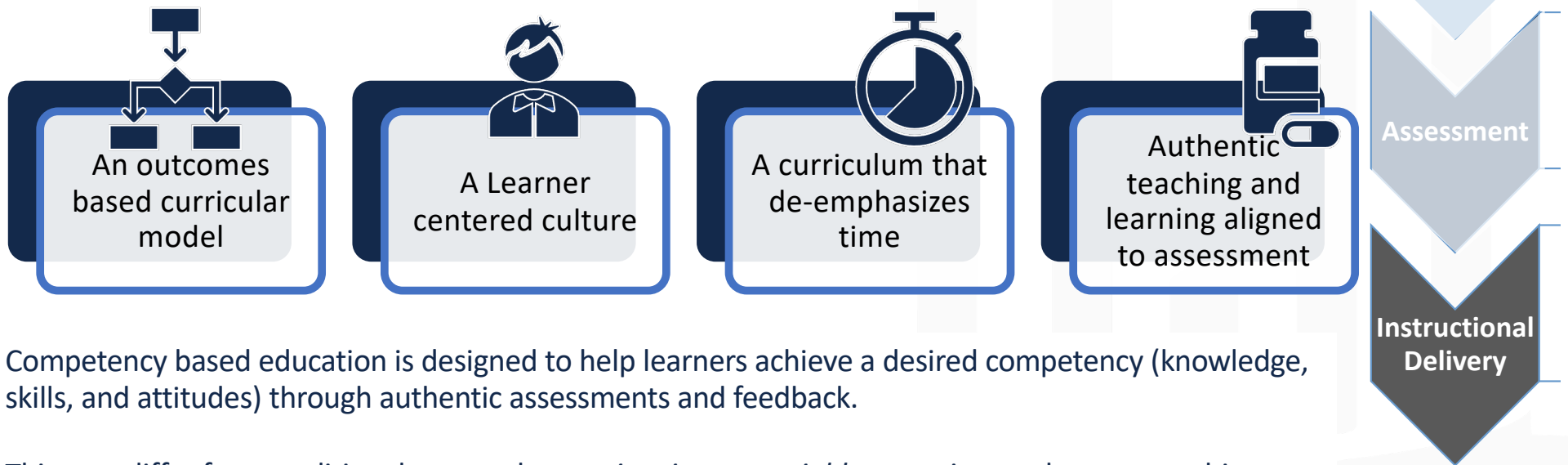# The Assistance Dilemma
To give or withhold

Benefit

Giving inf
(non-inte

What do you feel went well / could be improved (self-discovery)

Here is what I saw that went well / could be improved (assisted)

Koedinger and Aleven, Educational Psychology Review, 2007

Competency Based Education

Essential Elements

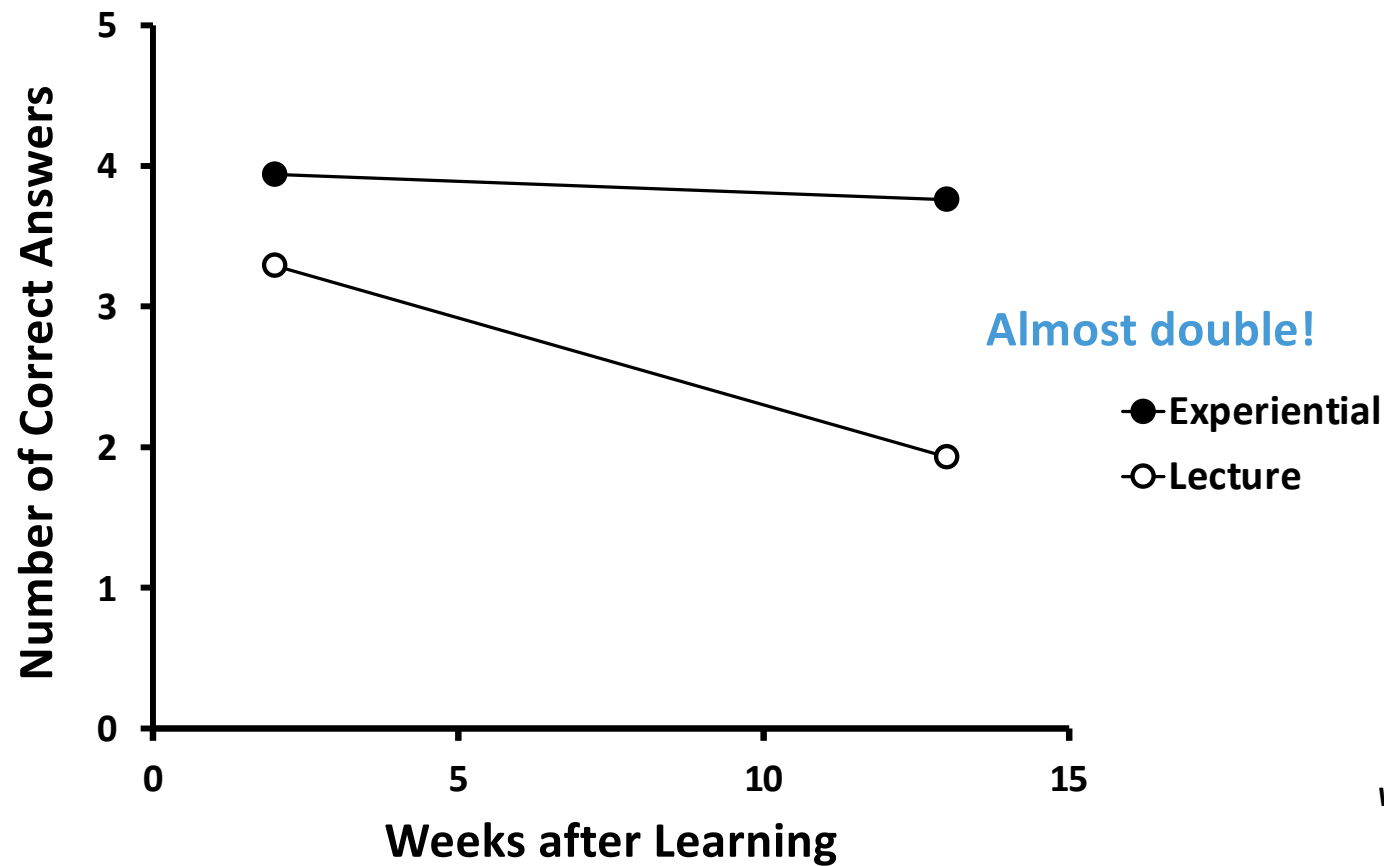|			
An outcomes based curricular model	A Learner centered culture	A curriculum that de-emphasizes time	Authentic teaching and learning aligned to assessment

Learning Goals

Assessment

Instructional Delivery

Competency based education is designed to help learners achieve a desired competency (knowledge, skills, and attitudes) through authentic assessments and feedback.

This may differ from traditional approaches as *time is now variable*, meaning students may achieve the desired level of competency at different times
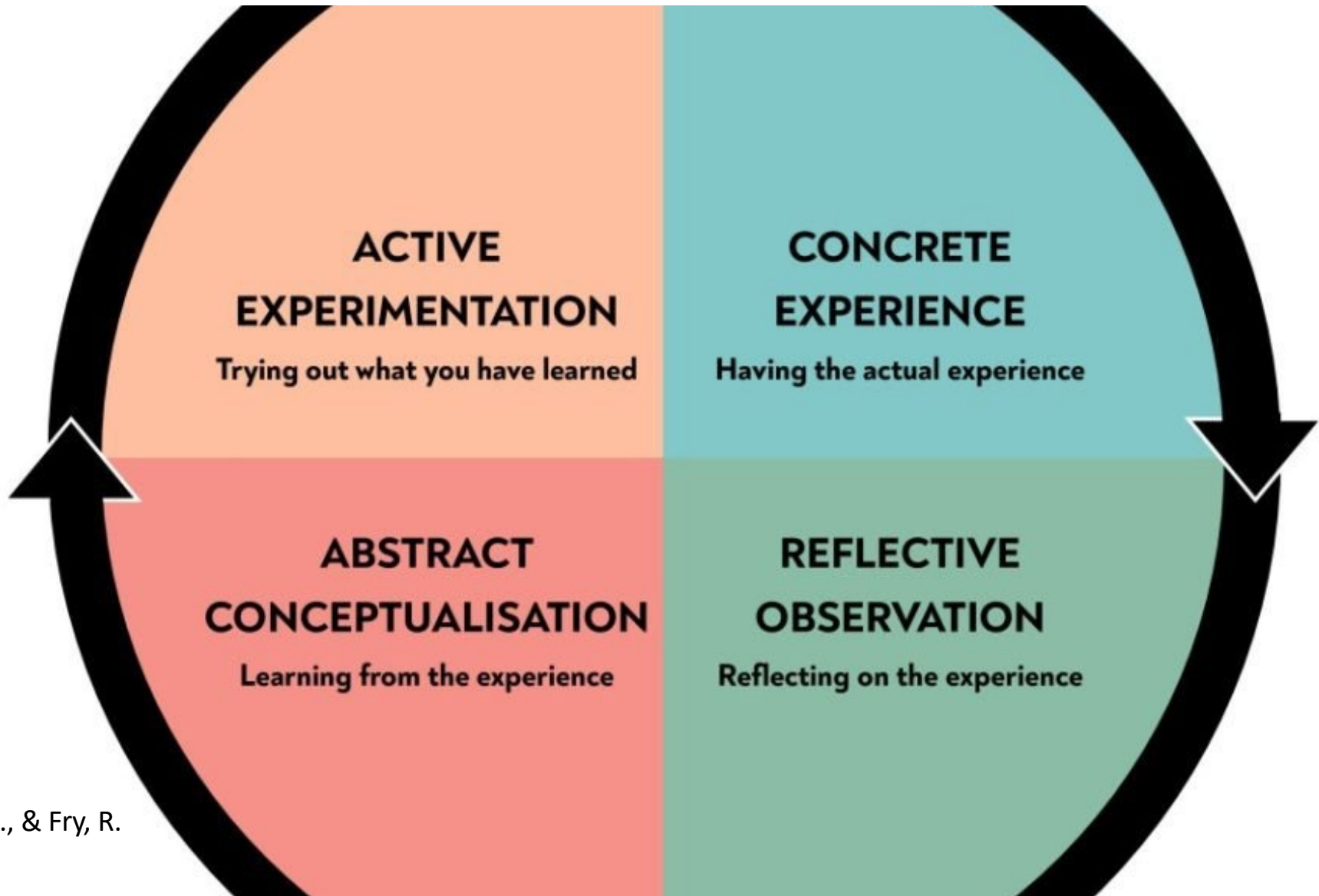
Experiential vs Lecture

Almost double!

●─ **Experiential**
○─ **Lecture**

Van Eynde et al., J Manag Educ, 12:52, 1988

Kolb, D. A., & Fry, R. (1975).

Summary

Applying the Science of Learning

- Understanding how we learn allows us to understand why we do what we do in the classroom and clinical environments

- Active learning is to enhance task-related thoughts. It is like bringing what you do in the clinic into the classroom

- Assessment tells students what you value and must be aligned with the goals of instruction and instructional methods.

- There are many ways to accomplish learning goals