教育學院

Faculdade de Educação

Faculty of Education

Active Learning in Undergraduate Teaching

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Objectives

1. Define scientific teaching and active learning;
2. Understand research underlying active learning;
3. Know how to implement active learning in the classroom;
4. Develop a framework for teaching as inquiry.

When poll is active respond at **PollEv.com/xiufengliu133**

Send **xiufengliu133** and your message to **+61 480 025 509**

What are your primary teaching methods in your undergraduate classes? Please use words or short phrases.

Nobody has responded yet.

Hang tight! Responses are coming in.

Powered by Poll Everywhere

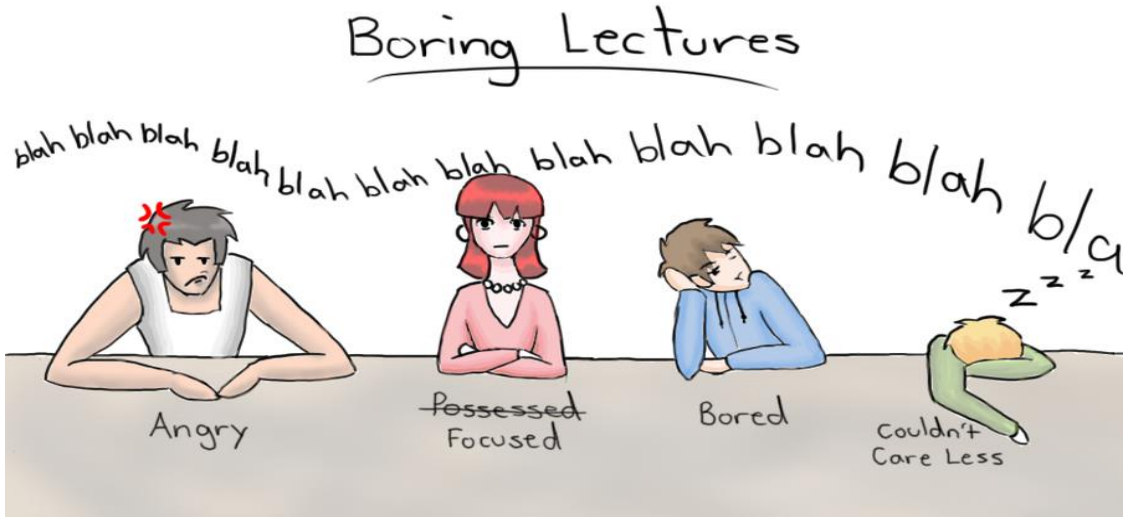
Current State of University Teaching

- Lecturing is the most commonly used teaching method in universities, and 66% of those teaching introductory classes reported lecturing in nearly every class
- Males lecture more then females and time on lecturing is positively related to class size

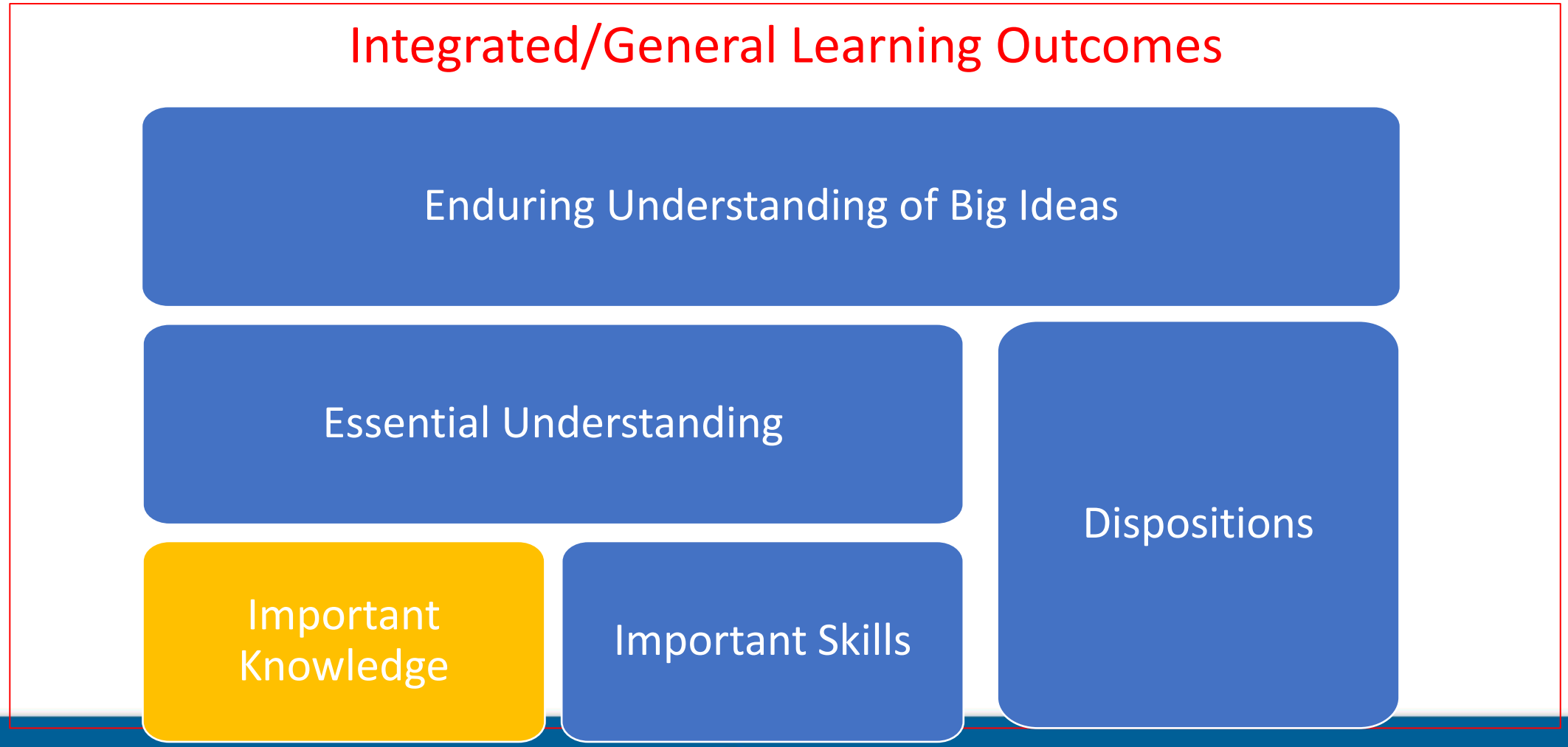
The Medieval Lecture Bologna 1350 (Laurentius de Voltolina)

Lecturing as a Teaching Method

- A discourse given before an audience for instruction
  - Lecturing is more than talking; gesture, movement, facial expression, eye contact and active engagement of the audience are essential
  - Lecturing is not the same as presentation
  - Lecturing does not have to be a stand-alone teaching method
  - Lecturing can only serve certain learning objectives



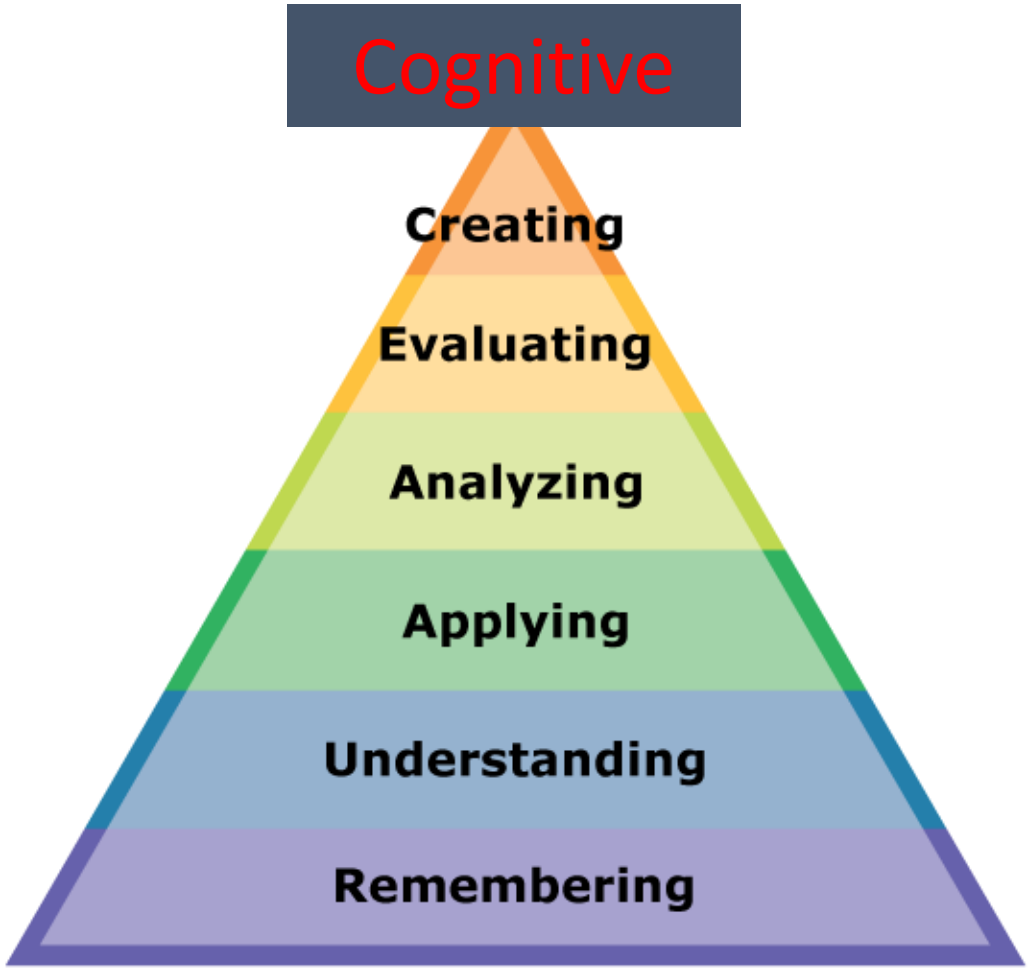
Learning Outcomes Lecturing Can Best Help Achieve



Learning Outcomes in Three Domains

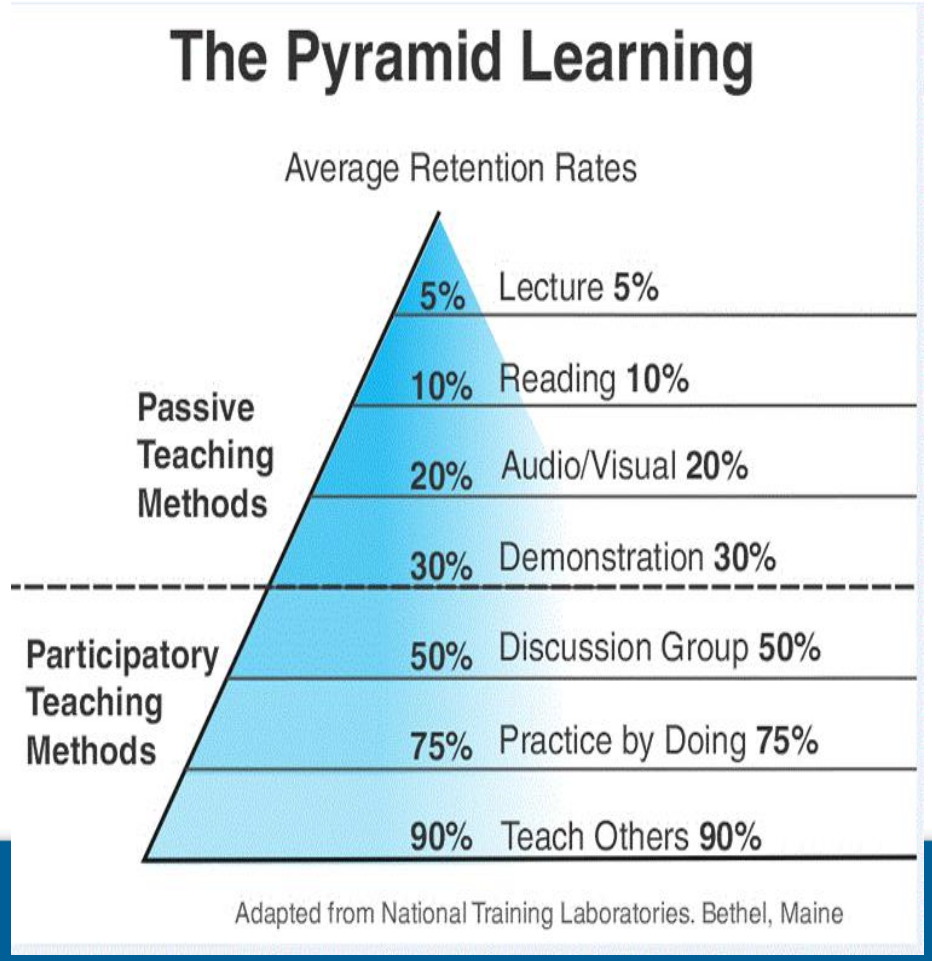
Affective: interest, motivation, valuing

Psychomotor: performing, adapting, originating

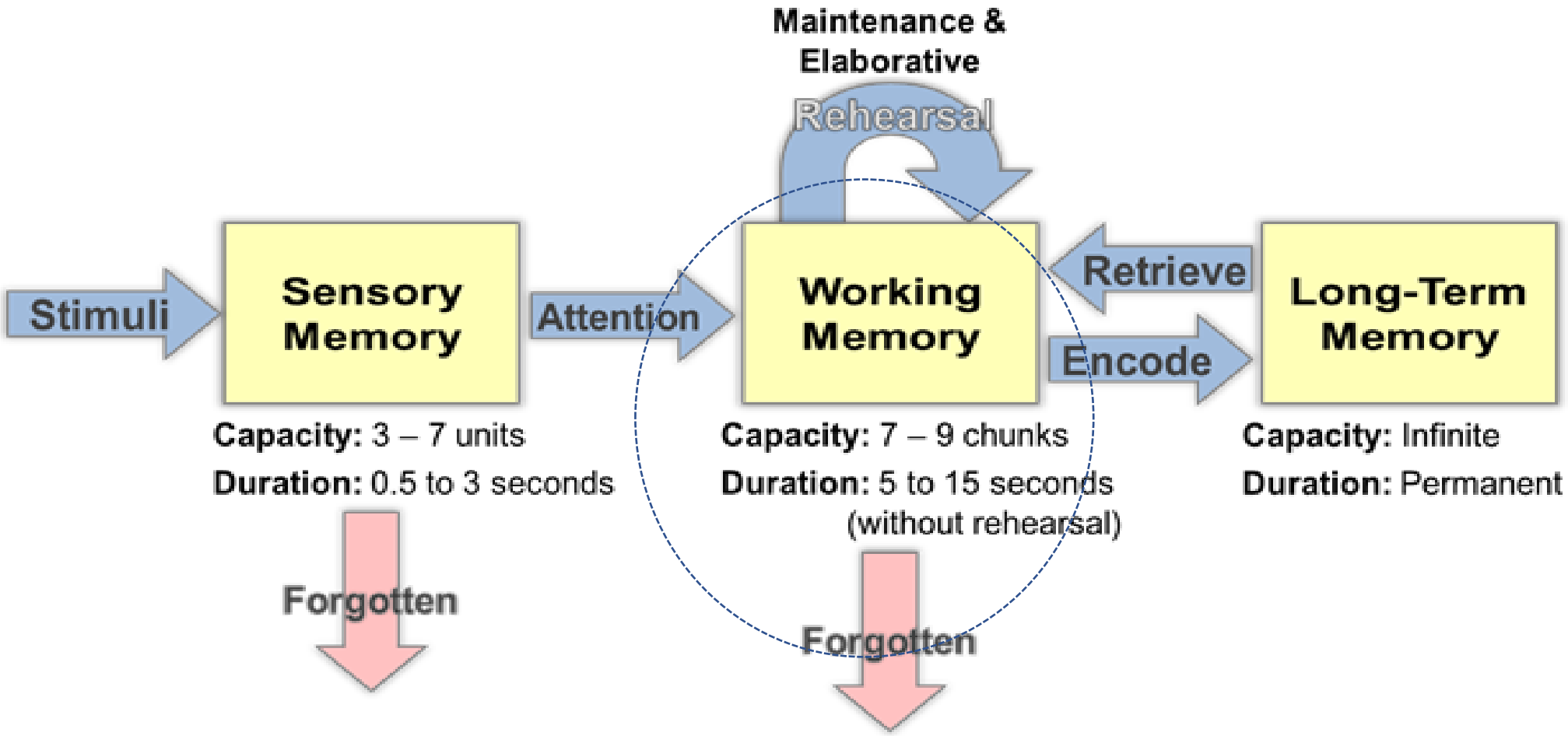


Is lecturing effective even for knowledge outcomes?

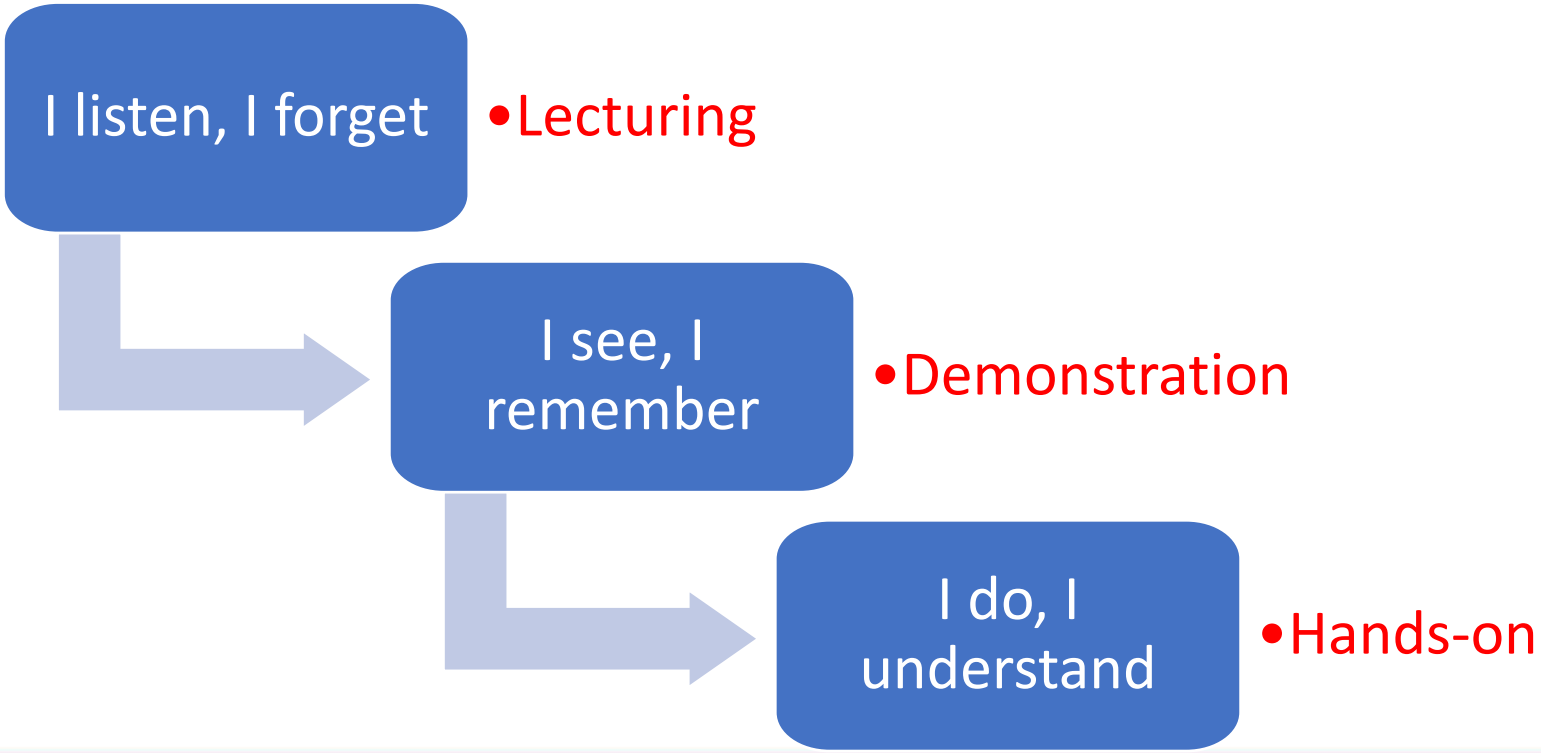
Lecturing ≠ Learning



Short-memory vs long-term memory



Ancient Chinese Wisdom

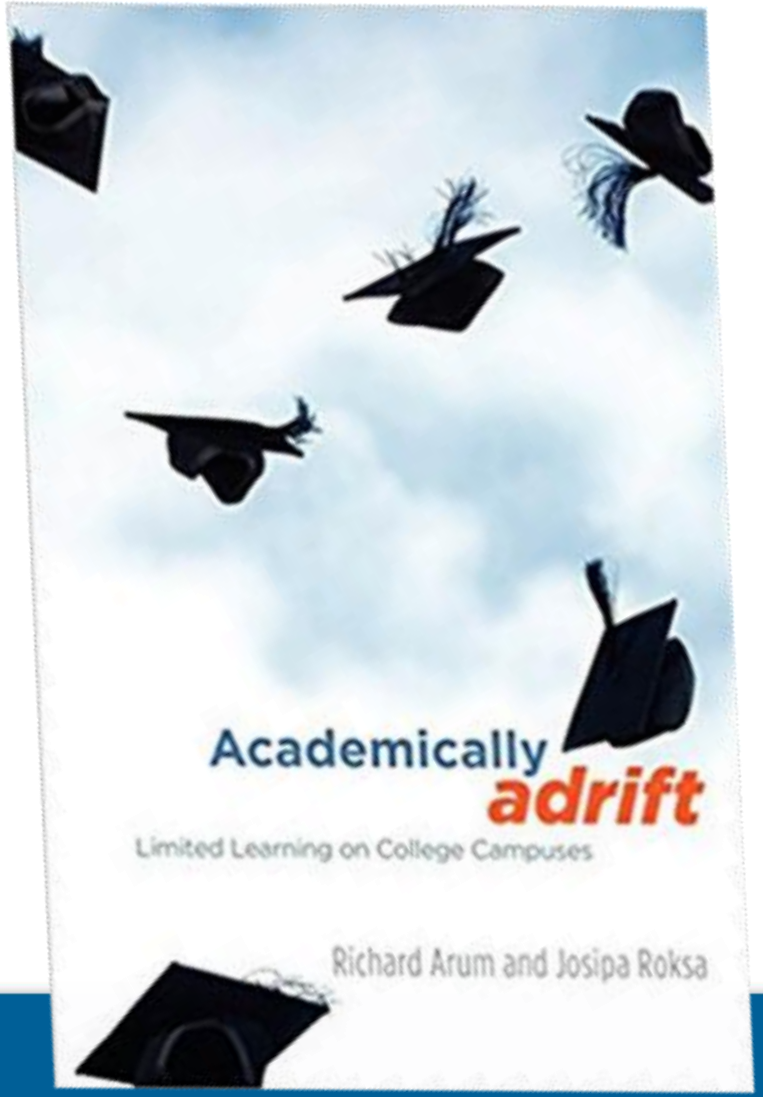


Student Learning in critical thinking, analytical reasoning, and problem solving and writing

Based on the Collegiate Learning Assessment (CLA) which consists of three open-ended performance assessment tasks and two analytical writing tasks:

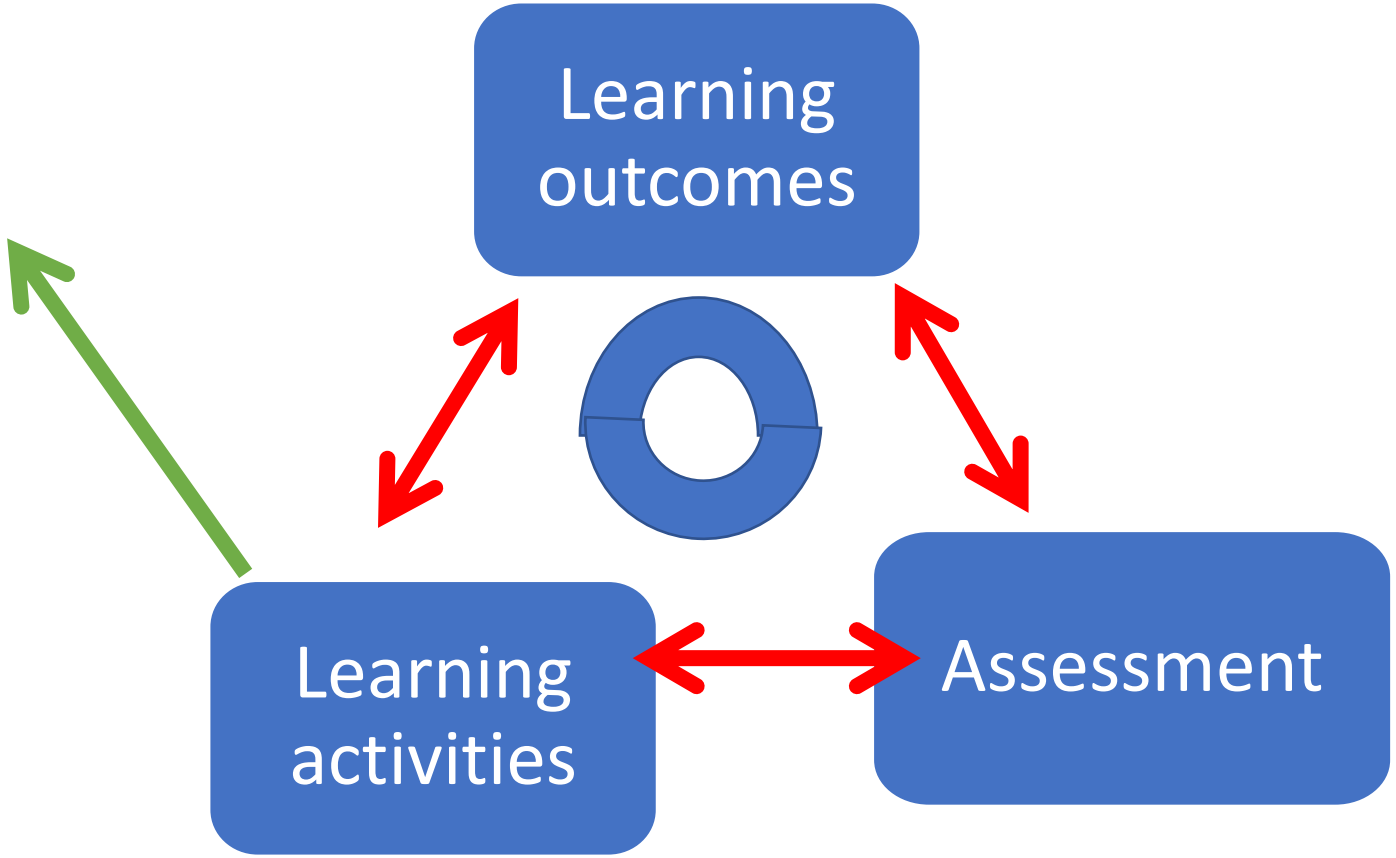
- From freshman entrance to the end of sophomore year, students have only improved on CLA scores by 0.18 standard deviation
- The gap between different racial groups, particularly between White and African-American, in CLA scores at the freshman entrance (~ 1 standard deviation) persists and even becomes bigger at the end of sophomore year

(Arum & Roksa, 2011)

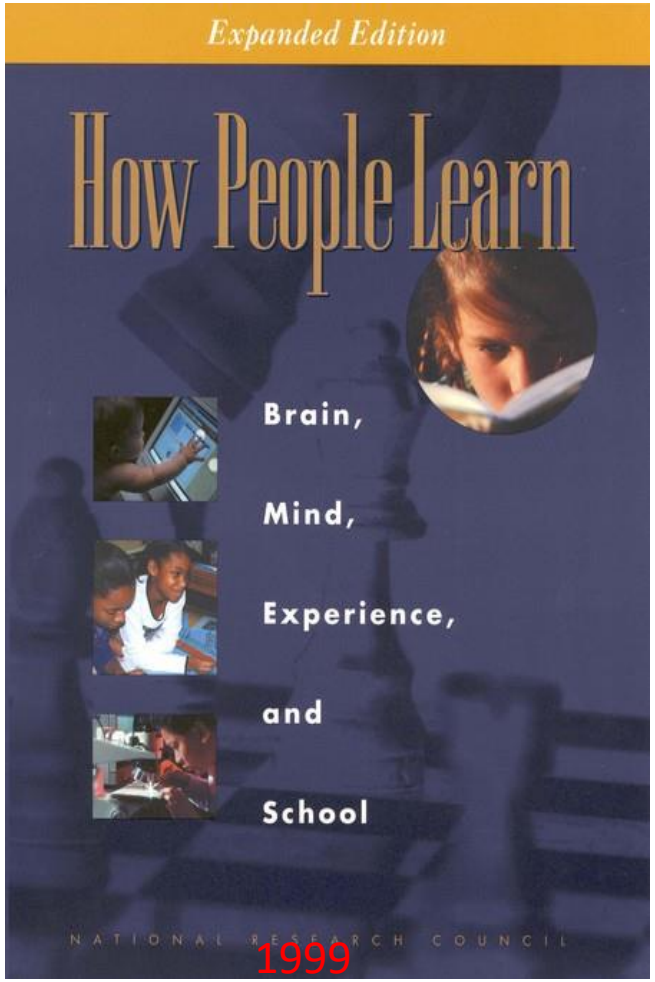


Basic Principle of Choosing Teaching Methods

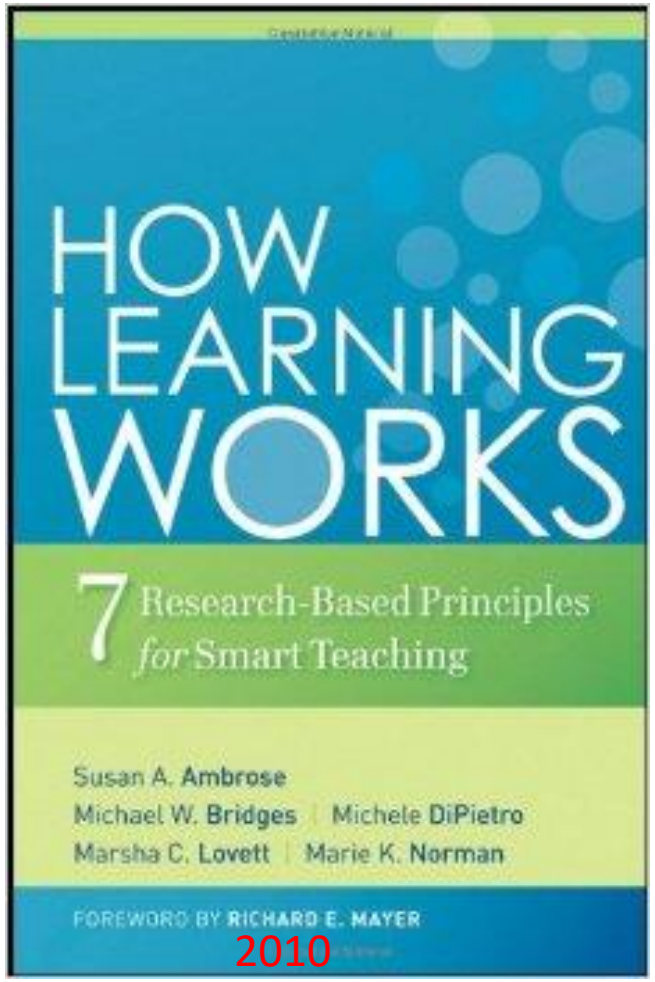
Teaching methods should be chosen according to the learning outcomes to be achieved.



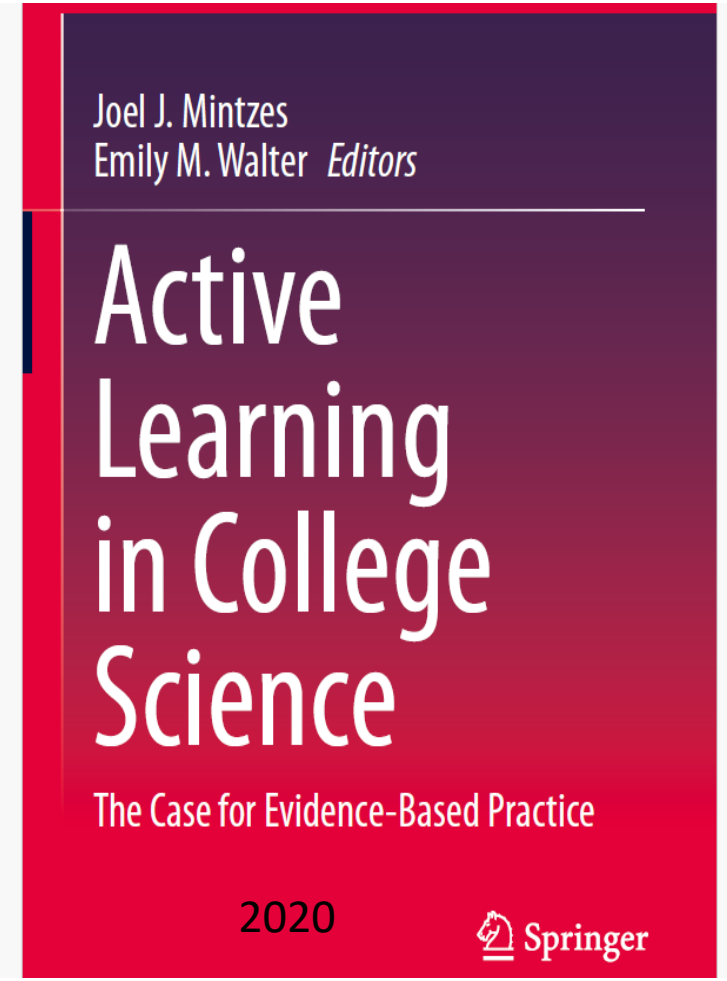
How people learn?



1999



2010



How students learn: Role of Prior Knowledge

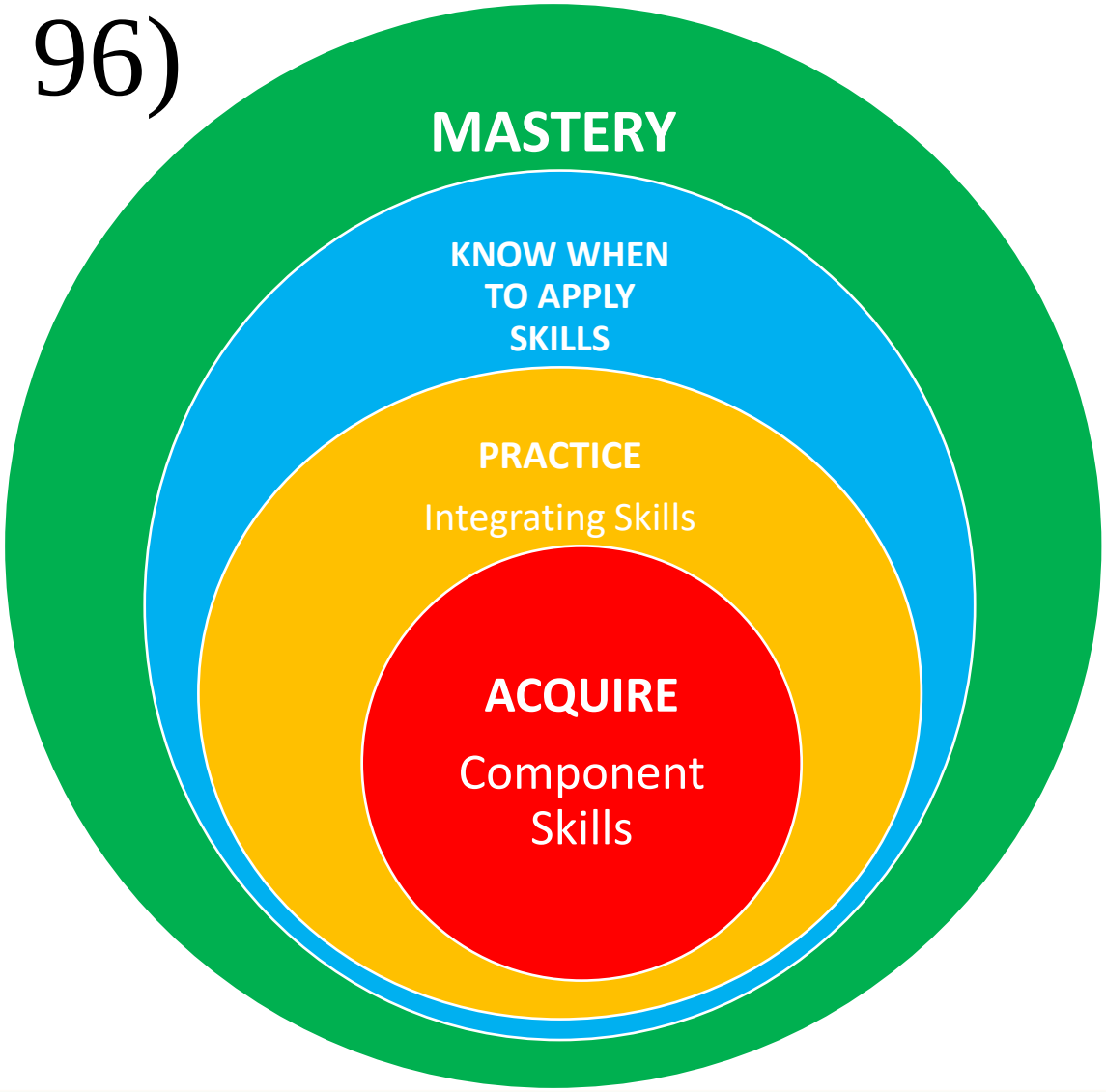
"If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly." (David Ausubel, 1968)

Learning Principle #1: Students' prior knowledge can help or hinder learning

https://www.youtube.com/watch?v=wOLph2zyiNY

Process to Become Mastery (Ambrose et al., 2010, p 96)

Learning Principle #2: To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned



How Students Learn: Student Motivation and Learning Environments

Learning Principle #3: Students' motivation generates, directs, and sustains what they do to learn.

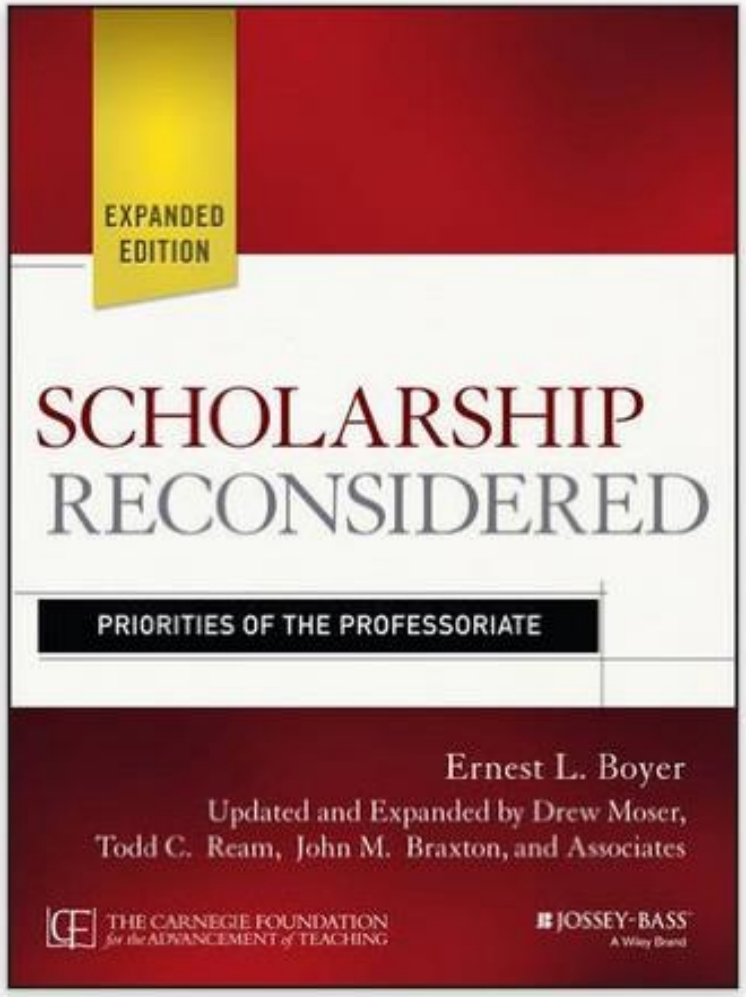
Learning Principle #4: Classroom learning environments (both physical and psychological) impact student learning

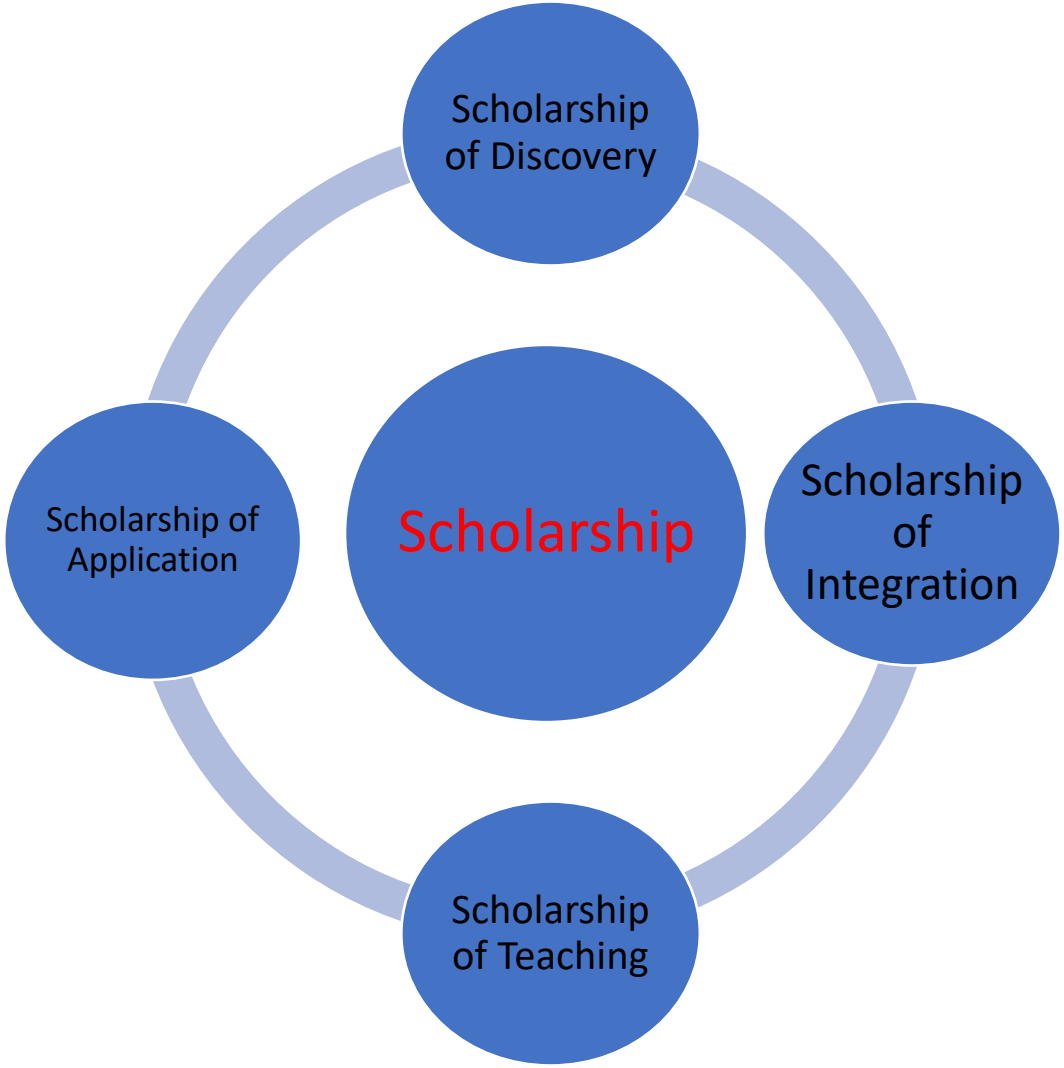
Teaching Scholarly and Teaching as Scholarship

- Scholarly Teaching
  - Use evidence-based teaching practices
  - Keep up to date with current literature
  - Apply learning theories to improve teaching
  - Engage in personal reflection

- TAS
  - Collect evidence/data about teaching and learning
  - Relate a problem to literature
  - Test hypothesis about teaching and learning
  - Sharing findings with colleagues publically

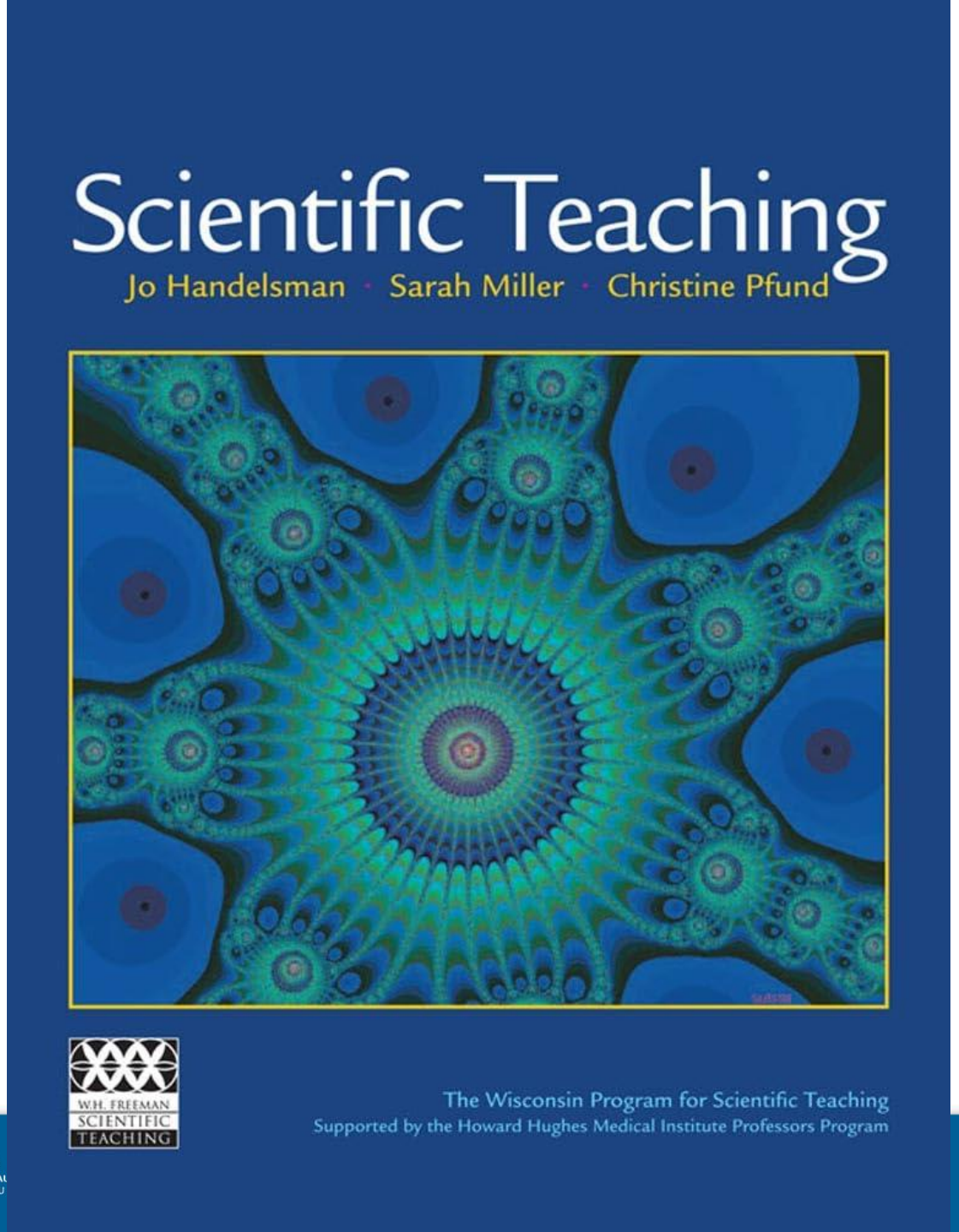
Teaching as Scholarship





Scientific Teaching

- Scientific teaching involves active learning strategies to engage students in the process of science and teaching methods. (Handelsman et al., 2004)
- ST encompasses three central tenets: active learning, assessment, and inclusivity.



Active Learning

- “Instructional activities involving students in doing things and thinking about what they are doing” (Bonwell, 1991).
- Active learning is a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content. Cooperative learning, problem-based learning, and the use of case methods and simulations are some approaches that promote active learning. (University of Michigan Center for Research on Teaching and Learning)

Outcome Method	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Lecture	X					
Interactive lecture	X	X	a	a	a	a
Recitation	X	X				
Directed discussion		X	a	a	a	a
Writing/speaking exercises		X	X	X	X	X
Classroom assessment techniques		X	X	X		X
Group work or learning		X	a	a	a	a
Student–peer feedback		X		X		X
Cookbook science labs		X	X			
Just-in-time teaching	X	X				
Case method			X	X	X	X
Inquiry based or inquiry guided	X[b]	X	X	X	X	X
Problem-based learning	X[b]		X	X	X	X
Project-based learning	X[b]	X	X	X	X	X
Role plays and simulations		X	X	X		X
Service-learning with reflection			X	X	X	X
Fieldwork/clinicals	X		X	X	X	X

Active Learning Strategies to Supplement Lecturing

- **The pause procedure/wait time**: pause for two minutes every 12 – 18 minutes (or at a logical place in the lecture), encouraging students to discuss and rework notes in pairs.
- **Retrieval practice**: Pause for two or three minutes every 15 minutes, having students write everything they can remember from preceding class segment.
- **Demonstrations**: Ask students to predict the result of a demonstration, briefly discussing with neighbors.
- **Peer instruction with ConceptTests**: Pose a conceptually based multiple-choice question, asking students to think about their answer and vote on a response before discussion.
- **Minute Paper**: Ask students a question that requires them to reflect on their learning or to engage in critical thinking

Active Learning to Partially Replace Lecturing

- **Strip sequence:** Students are given the steps in a process on strips of paper, which are jumbled. They are then asked to work together to reconstruct the proper sequence.
- **Concept map**: Concept maps are visual representations of the relationships between concepts.
- **Categorizing grids**: Students are presented with a grid made up of several important categories and a list of scrambled terms, images, equations, or other items, and ask students to quickly sort the terms into the correct categories in the grid.
- **Student-generated test questions**: Provide students with a copy of your learning goals for a particular unit and a figure summarizing Bloom's taxonomy, Challenge groups of students to create test questions corresponding to your learning goals.
- **Decision-making**: Provide a short description of a thorny problem, ask them to work in groups to arrive at a decision, and then have groups share out their decisions and explain their reasoning.
- …

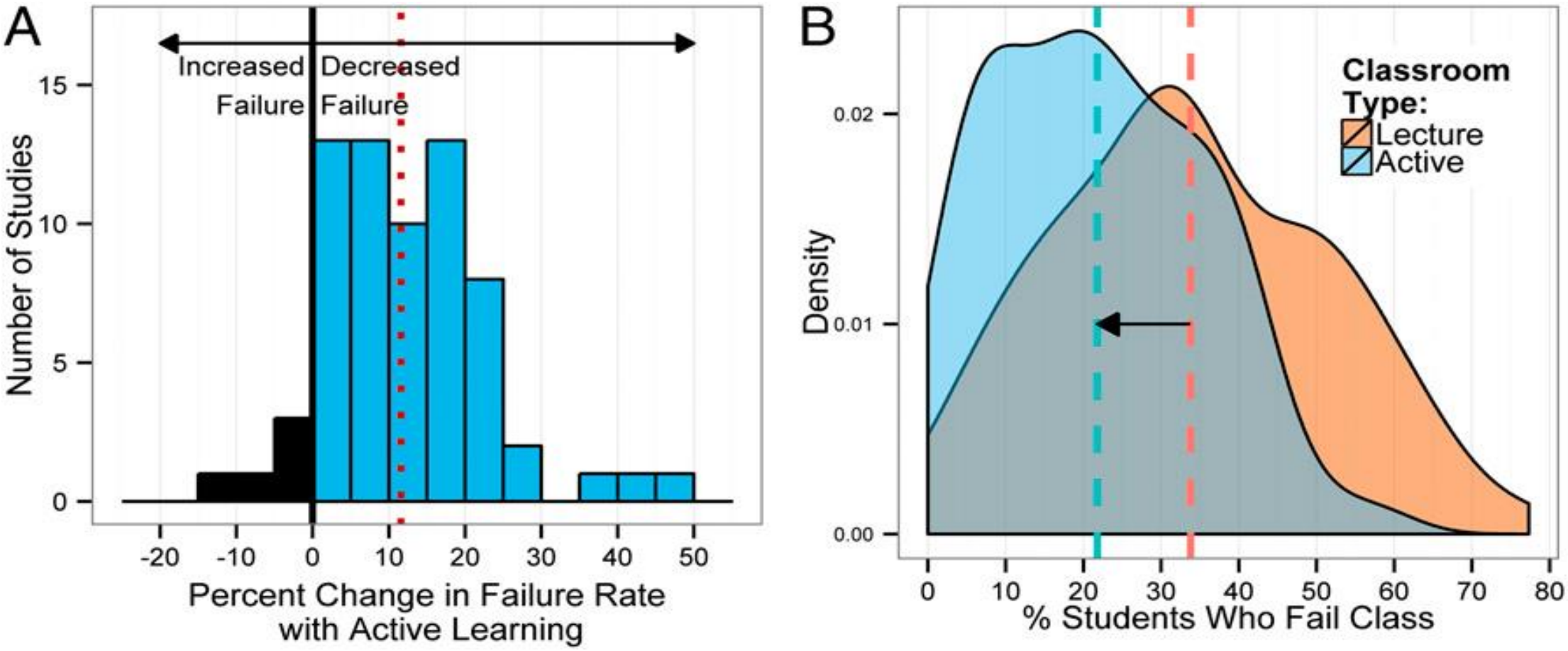
Active Learning to Replace Lecturing Entirely

- Problem-based learning
- Project-based learning
- Cased- Based Learning
- …

Active Learning in Action: Large Introductory Physics Class

- http://blogs.ubc.ca/wpvc/intro-physics-active-class/

Effectiveness of Active Learning

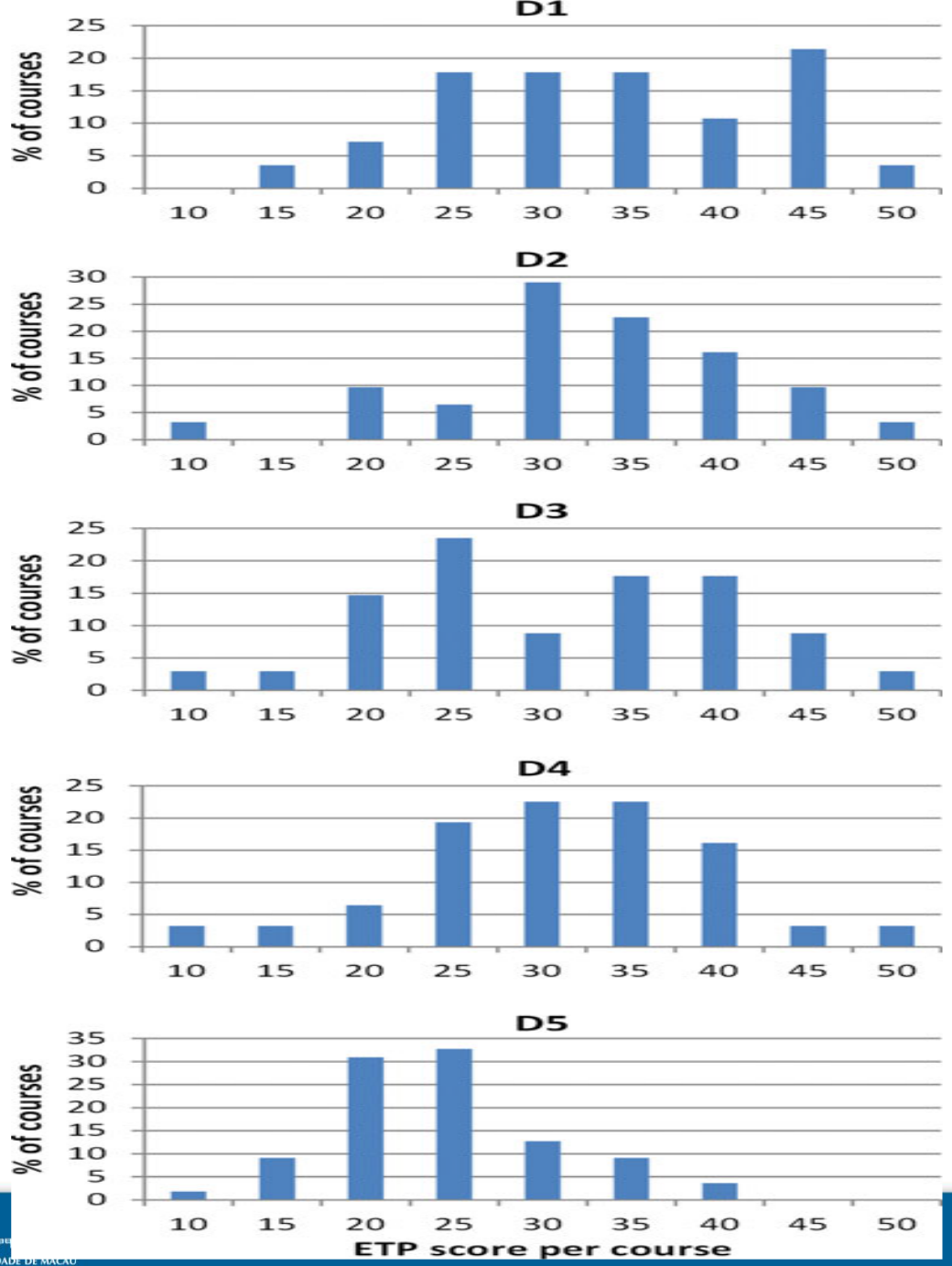


(Freeman et al., (2014)

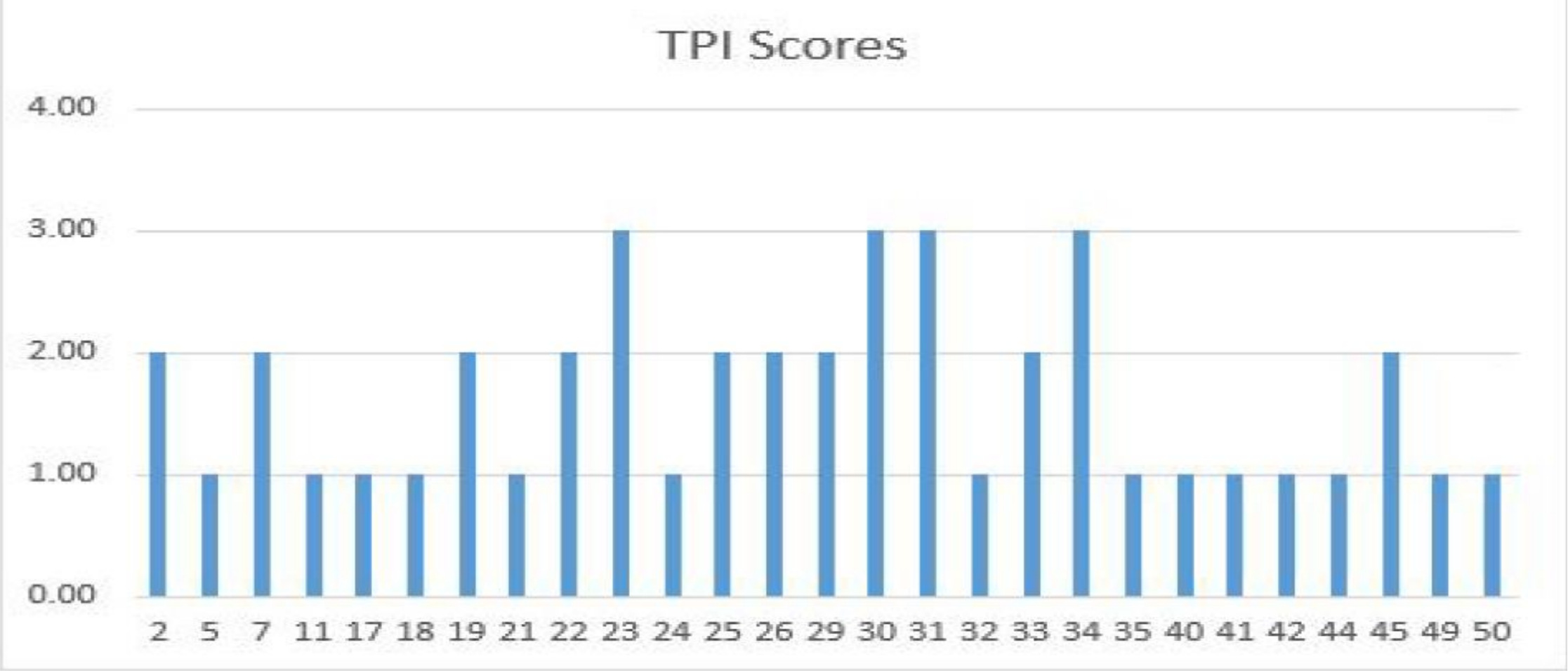
Teaching Practice Inventory (Wieman & Gilbert, 2014)

1. Course information provided
2. Supporting materials provided
3. In-class features and activities
4. Assignments
5. Feedback and testing
6. Other (diagnostics, pre-post testing)
7. Training and guidance of TAs
8. Collaboration or sharing in teaching

Teaching Practice Inventory (Wieman & Gilbert, 2014)



Teaching Practice Inventory: UB Gateway Courses in Math, Biology, Chemistry and Physics



Activity

- Use the TPI to score your own instruction of an undergraduate course.
- Share your results

The Classroom Observation Protocol for Undergraduate STEM (COPUS) (Smith et al., 2013)

1. Students are Doing

L	Listening to instructor/taking notes, etc.
Ind	Individual thinking/problem solving. Only mark when an instructor explicitly asks students to think about a clicker question or another question/problem on their own.
CG	Discuss clicker question in groups of 2 or more students
WG	Working in groups on worksheet activity
OG	Other assigned group activity, such as responding to instructor question
AnQ	Student answering a question posed by the instructor with rest of class listening
SQ	Student asks question
WC	Engaged in whole class discussion by offering explanations, opinion, judgment, etc. to whole class, often facilitated by instructor
Prd	Making a prediction about the outcome of demo or experiment
SP	Presentation by student(s)
TQ	Test or quiz
W	Waiting (instructor late, working on fixing AV problems, instructor otherwise occupied, etc.)
O	Other – explain in comments

2. Instructor is Doing

Lec	Lecturing (presenting content, deriving mathematical results, presenting a problem solution, etc.)
RtW	Real-time writing on board, doc. projector, etc. (often checked off along with Lec)
FUp	Follow-up/feedback on clicker question or activity to entire class
PQ	Posing non-clicker question to students (non-rhetorical)
CQ	Asking a clicker question (mark the entire time the instructor is using a clicker question, not just when first asked)
AnQ	Listening to and answering student questions with entire class listening
MG	Moving through class guiding ongoing student work during active learning task
1o1	One-on-one extended discussion with one or a few individuals, not paying attention to the rest of the class (can be along with MG or AnQ)
D/V	Showing or conducting a demo, experiment, simulation, video, or animation
Adm	Administration (assign homework, return tests, etc.)
W	Waiting when there is an opportunity for an instructor to be interacting with or observing/listening to student or group activities and the instructor is not doing so
O	Other – explain in comments

Smith MK, Jones FHM, Gilbert SL, and Wieman CE. 2013. The Classroom Observation Protocol for Undergraduate STEM (COPUS): a New Instrument to Characterize University STEM Classroom Practices. CBE-Life Sciences Education, Vol 12(4), pp. 618-627; www.cwsei.ubc.ca/resources/COPUS.htm

Date: _____ **Class:** _____ **Instructor:** _____ **No. students** _____ **Observer Name:** _____

Classroom arranged how? _____

1. **L**-Listening; **Ind**-Individual work; **CG**-Clicker Q discussn; **WG**-Worksheet group work; **OG**-Other group work; **AnQ**-Answer Q; **SQ**-Student Q; **WC**-Whole class discuss.; **Prd**-Predicting; **SP**-Student present.; **TQ**-Test/quiz; **W**-Waiting; **O**-Other
2. **Lec**-Lecturing; **RtW**-Writing; **FUp**-Follow-up; **PQ**-Pose Q; **CQ**-Clicker Q; **AnQ**-Answer Q; **MG**-Moving/Guiding; **1o1**-One-on-one; **D/V**-Demo+; **Adm**-Admin; W-Waiting; **O**-Other

For each 2 minute interval, check columns to show what's happening in each category (or draw vertical line to indicate continuation of activity). Check multiple columns where appropriate.

COPUS

	1. Students doing													2. instructor doing											3. Engagement			Comments: EG: explain difficult coding choices, flag key points for feedback for the instructor, identify good analogies, etc.
min	L	Ind	CG	WG	OG	AnQ	SQ	WC	Prd	SP	T/Q	W	O	Lec	RtW	Fup	PQ	CQ	AnQ	MG	1o1	D/V	Adm	W	O	L	M	H	
0 - 2																													
2																													
4																													
6																													
8 - 10																													
	L	Ind	CG	WG	OG	AnQ	SQ	WC	Prd	SP	T/Q	W	O	Lec	RtW	Fup	PQ	CQ	AnQ	MG	1o1	D/V	Adm	W	O	L	M	H	
10 - 12																													
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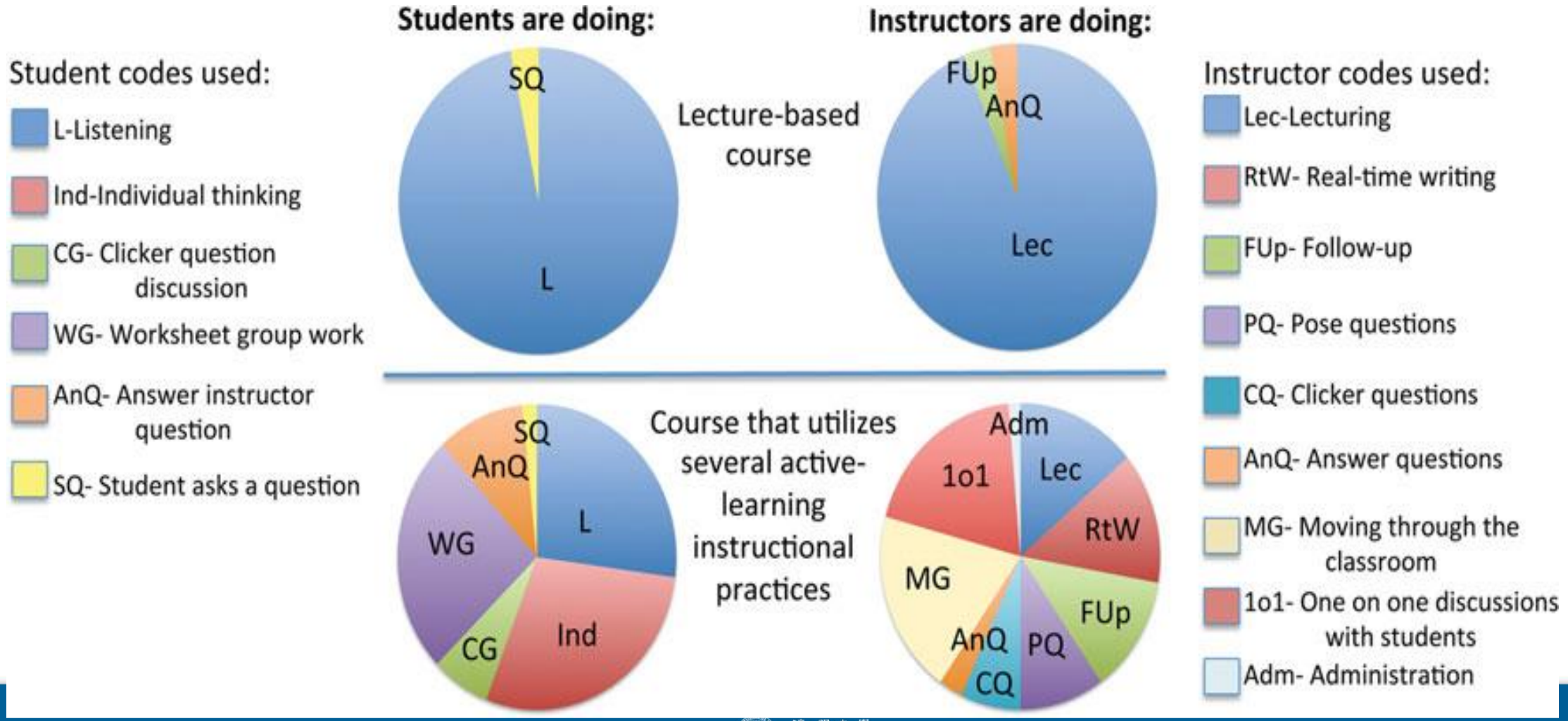
The Classroom Observation Protocol for Undergraduate STEM (COPUS) (Smith et al., 2013)



Group Discussion

- How may COPUS be used to improve university teaching?

Summary

1.Principles of effective learning:

2. Active learning:

1.Scholarship of teaching:

Thank you.

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