Supporting All Students Through Your Teaching

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With material from Karen Kortz , David McConnell, Barb Tewksbury, Karl Wirth, & Richard Yuretich

This morning's session

- **Students as learners**
  - *Scenario discussion*
- **Course design process**
  - Course context
  - Goals
    - *Writing goals exercise*
  - Activities
    - *Jigsaw activity*
  - Assessment & Feedback
- **Reflection**
- **Resources**

Photo: Joshua Villalobos

Scenario Discussion

1. Individually, read one of the scenarios.
2. As a table, discuss the problems.
3. Guided discussion among all.

Many students need our help in "learning to learn" = metacognition

Novice → **Expert**

Few strategies

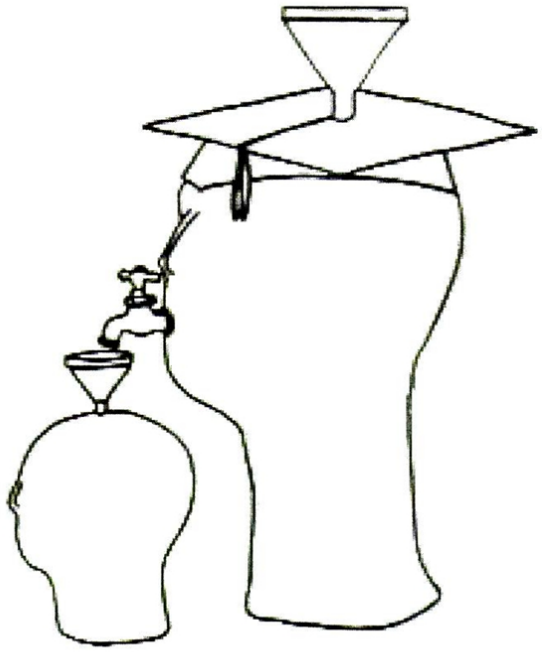
Many strategies

Elapsed Time (mins)	0	2	4	6	8	10	12	14	16	18
Read										
Analyze										
Explore										
Plan										
Implement										
Verify										

Elapsed Time (mins)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Read																				
Analyze																				
Explore																				
Plan																				
Implement																				
Verify																				

From K. Wirth with data from
Schoenfeld (1987) Mathematical Problem Solving

Common Way to Plan a Course



Choose textbook

⇓

Develop syllabus

⇓

Write/revise lectures, notes

⇓

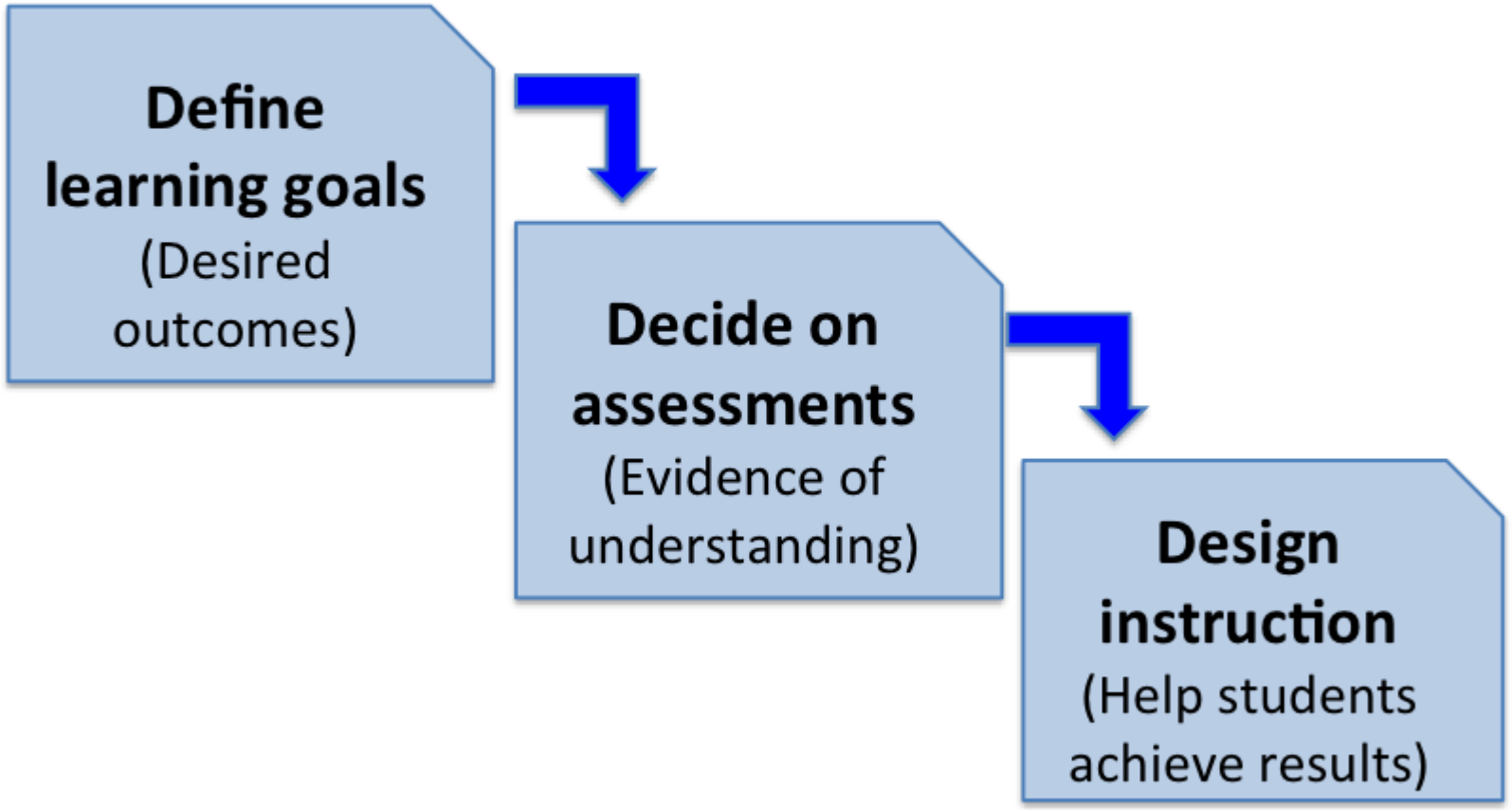
Prepare PowerPoint presentations

⇓

Write quizzes and mid term and final exams

Alternative Way to Plan a Course

"Backwards design": Start at the End



Resource: Wiggins and McTighe (2006). Understanding by Design

We can help students learn by how we design our courses

- Consider **course context**
- Articulate **goals and outcomes**
- Plan **assessment & feedback**
- Design **activities**

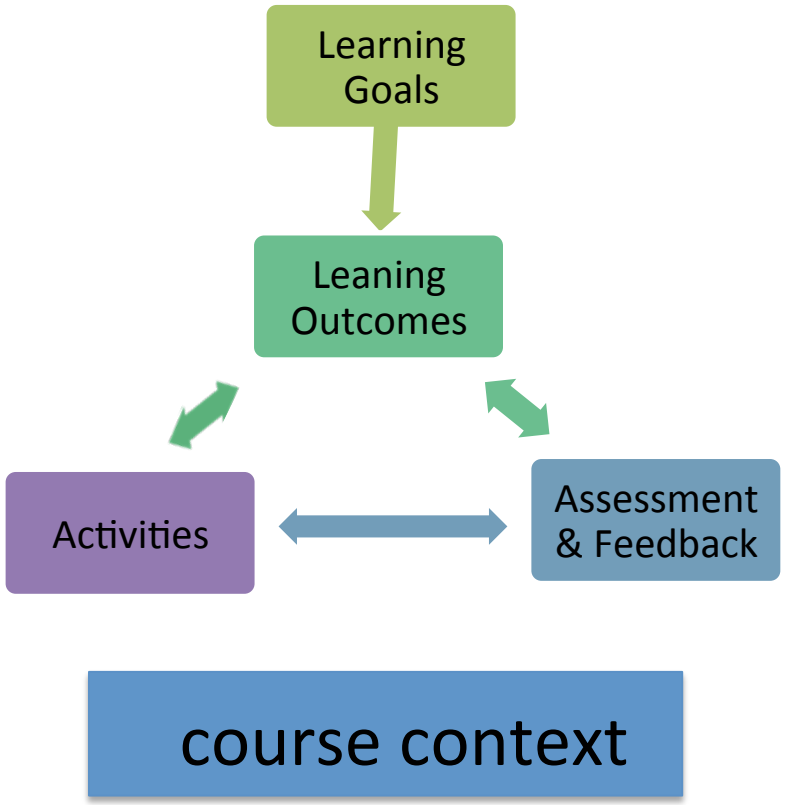


Figure modified from D. McConnell

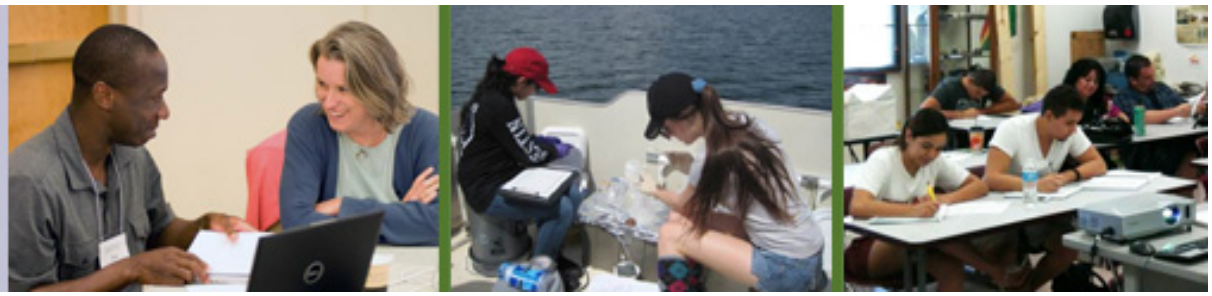
http://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/index.html

Handelsman, J, S. Miller &C. Pfund. 2007. Scientific Teaching. WH Freeman and Co.

Focus on one of your courses

SAGE 2YC

Supporting and Advancing Geoscience Education in Two-year Colleges



Consider course context

Each class has a different context.
These differences influence the course design.

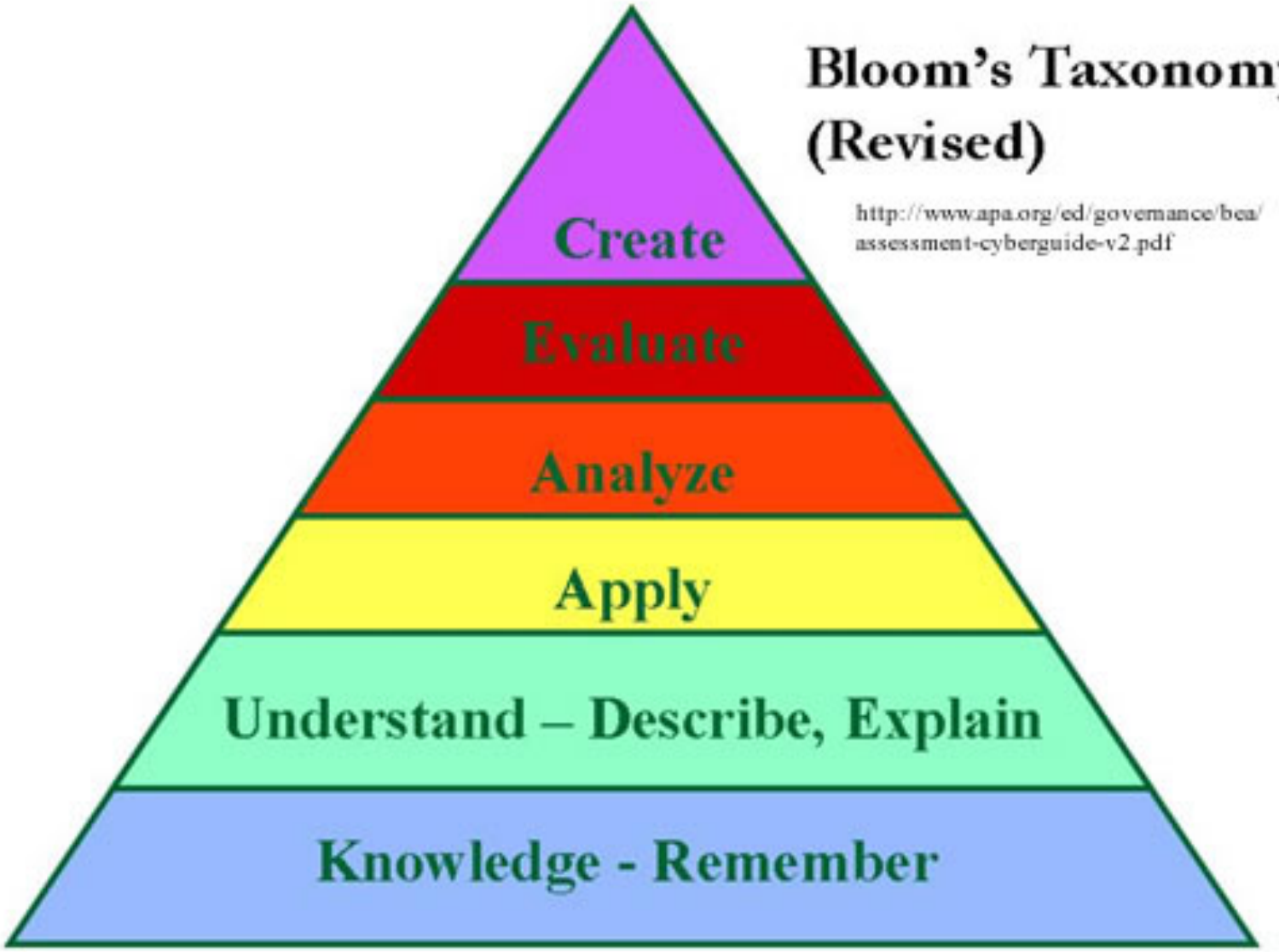
- **Motivation**
  gen-ed, required for major transfer, elective,?
- **Class size**
  <10, 10-25, >25
- **Format**
  lecture, lecture + lab, on-line, flipped?

Goals

What do you want students to be able to know and be able to do as a result of taking your course?

- What problems should students be able to solve?
- How will students apply what they have learned?
- How will students be different at the end of the course?

Photo by C. Field



Based on an APA adaptation of Anderson, L.W. & Krathwohl, D.R. (Eds.) (2001)

Active verbs developed based on Bloom's Taxonomy

Knowledge	Understand	Apply	Analyze	Evaluate	Create
define	explain	solve	analyze	reframe	design
identify	describe	apply	compare	criticize	compose
describe	interpret	illustrate	classify	evaluate	create
label	paraphrase	modify	contrast	order	plan
list	summarize	use	distinguish	appraise	combine
name	classify	calculate	infer	judge	formulate
state	compare	change	separate	support	invent
match	differentiate	choose	explain	compare	hypothesize
recognize	discuss	demonstrate	select	decide	substitute
select	distinguish	discover	categorize	discriminate	write
examine	extend	experiment	connect	recommend	compile
locate	predict	relate	differentiate	summarize	construct
memorize	associate	show	discriminate	assess	develop
quote	contrast	sketch	divide	choose	generalize
recall	convert	complete	order	convince	integrate
reproduce	demonstrate	construct	point out	defend	modify
tabulate	estimate	dramatize	prioritize	estimate	organize
tell	express	interpret	subdivide	find errors	prepare
copy	Identify	Manipulate	survey	grade	produce
discover	indicate	Paint	advertise	measure	rearrange
duplicate	Infer	Prepare	appraise	predict	rewrite
enumerate	relate	produce	Break down	rank	role-play

www.mesacc.edu/employees/curriculum/resources/blooms-higher-level-verbs

Goals-based approach

Emphasizes designing a course for which:

- Students learn significant content & skills
- Students practice thinking & solving problems
- Students leave prepared to apply knowledge & skills

Sets goals that:

- Involve higher-order thinking skills
- Are student centered
- Can be assessed in multiple ways

Course Goals

1. Students will understand plate tectonics
2. Students will interpret unfamiliar tectonic settings based on information on landforms, seismicity, and volcanic activity
3. Students will learn to appreciate the natural world
4. Students will predict the weather given appropriate meteorological data
5. Students will be provided with an introduction to the geology of environmental issues
6. Students will explain how geologists use radioactive decay of elements to determine the ages of rock
7. Students will critically review web site articles about oceanographic processes

What goals will you set for your course?

- Consider & complete

  "When students have completed the course, they should be able to…"

- Try verbs such as

  derive, predict, analyze, design, interpret, synthesize, formulate, plan, correlate, evaluate, create, critique, adapt

Review goals

- Does the goal focus on **higher-order thinking**?
- Is the goal **student-focused**?
- Can you **assess** in multiple ways whether students have achieved the goal?

Course design

- Consider **course context**
- Articulate **goals and outcomes**
- Plan **assessment & feedback**
- Design **activities**

Students learn when they are actively engaged in practice, application, and problem solving.

(NRC, 1999 How People Learn)

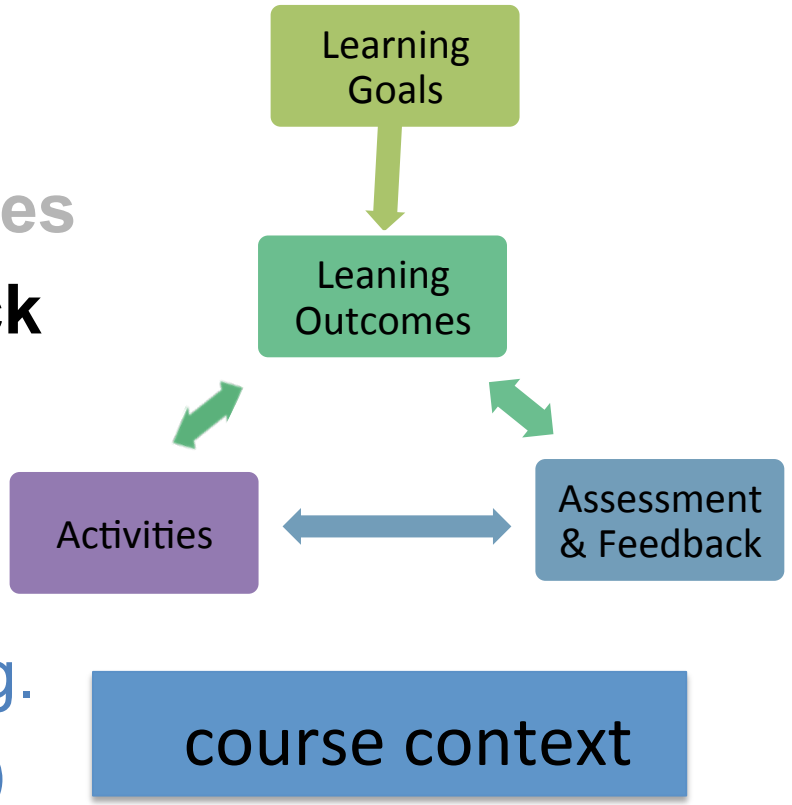


Figure modified from D. McConnell

Student retention rate over a 24 hour period from different teaching methods

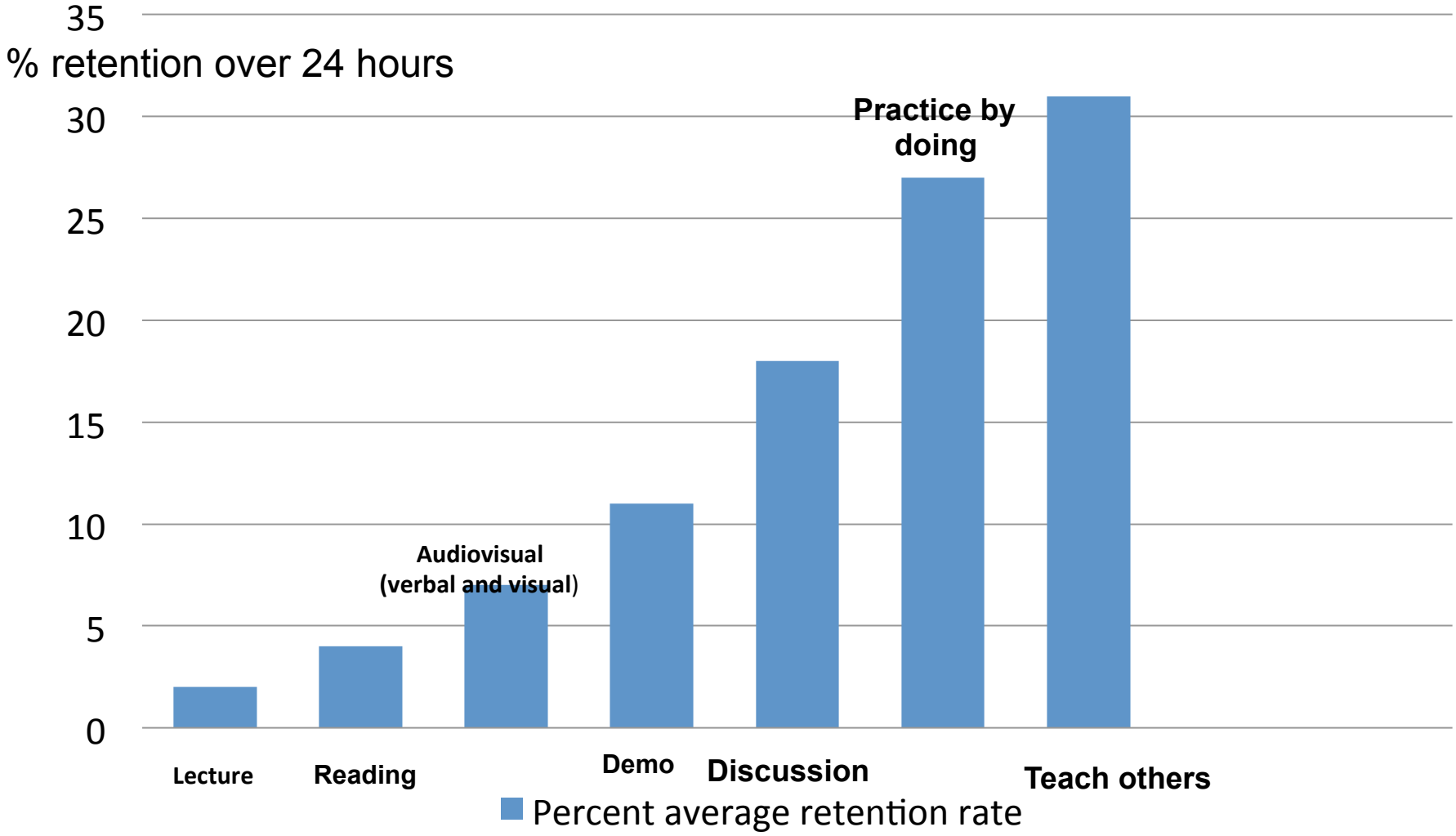
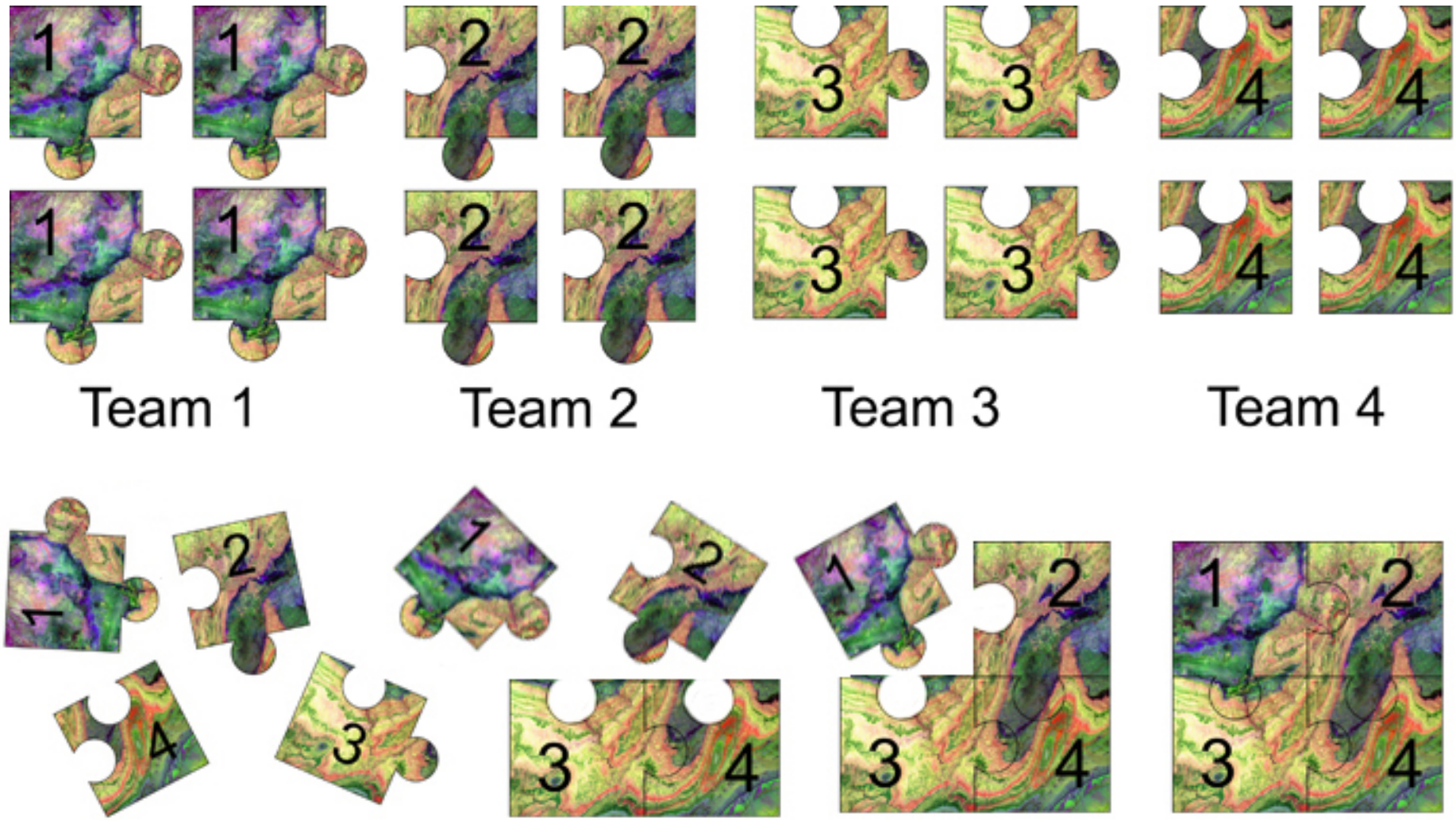


Chart made from data in Sousa 2006. How The Brain Learns. Fig 11.1 in Barkley 2010. Student Engagement Techniques

Active learning method: Jigsaw



From Barbara Tewksbury
http://serc.carleton.edu/NAGTWorkshops/teaching_methods/jigsaws/index.html

Jigsaw Examples

- **Plate tectonics:** Teams analyze earthquake, volcano, seafloor age, and topographic maps, then combine to draw plate boundaries and interpret processes.
- **Google Earth:** Teams analyze different locations that show similar features (e.g., barrier islands, folds, valley glaciers, volcanic cones, etc.), then combine to discuss similarities and differences of the feature.

http://serc.carleton.edu/sp/library/jigsaws/examples.html

Your turn: Jigsaw on active learning
Part I *(Teams analyze…)*

Count off 1-6 at your table. Move to the poster that corresponds with your number and read the poster.

Talk to your poster team members:

- Summarize the method.
- When would the technique be especially useful?
- For what courses/topics might the technique not work as well?
- How much preparation before class does the technique require?

Your turn: Jigsaw on active learning Part II *(then combine…)*

Return to your table and as a group:

Briefly describe each method (teach each other)

Rank the methods by time required for preparation.

What are 3 activities that use different active learning methods to help students *interpret graphs.*

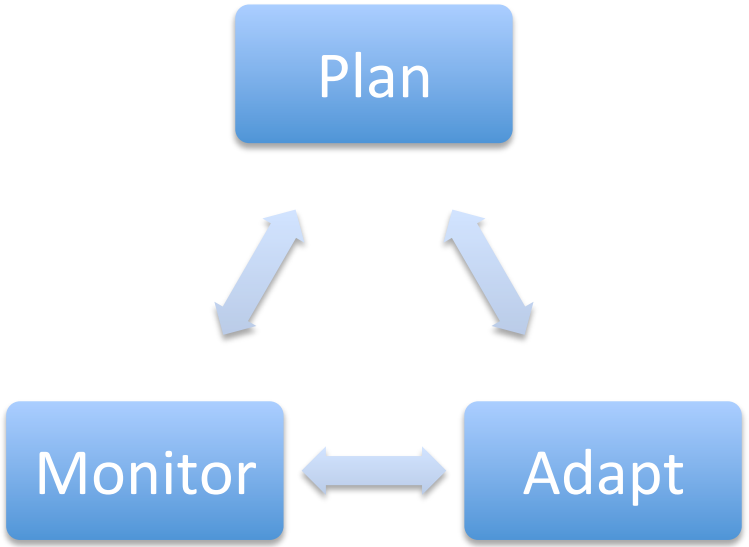
Active learning supports metacognition

Three basic steps to teaching students metacognition:

1. Teach students that their ability to learn can be changed.

2. Teach planning & goal-setting.

3. Provide students opportunities to monitor and adapt their learning.

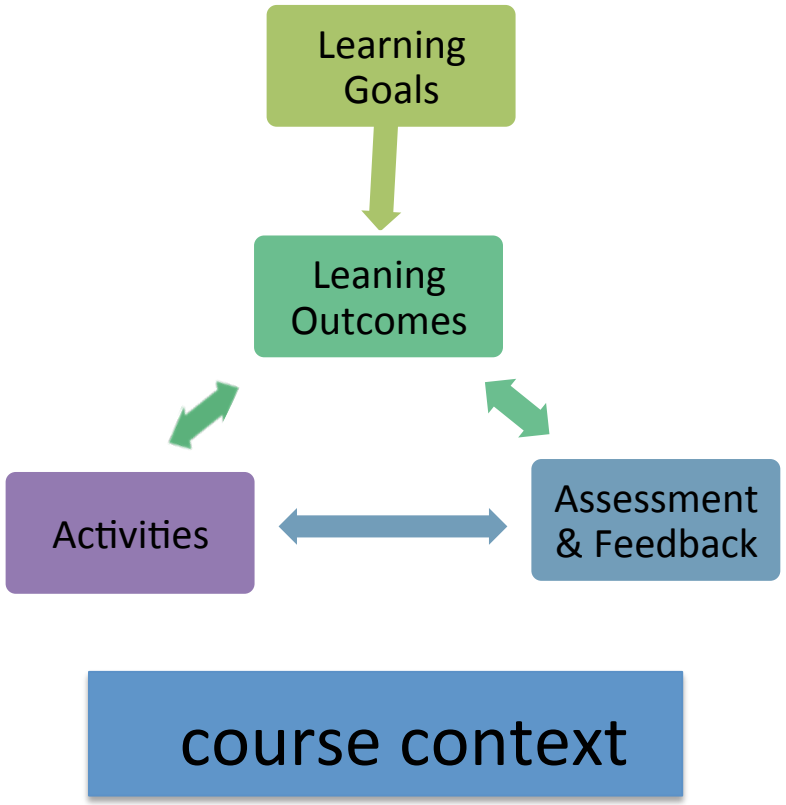


Summarized from Lovett, 2008, Educause Learning Initiative Conference

http://serc.carleton.edu/NAGTWorkshops/metacognition/index.html

Assessment and Feedback

- Consider **course context**
- Articulate **goals and outcomes**
- Plan **assessment & feedback**
- Design **activities**



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Handelsman, J, S. Miller &C. Pfund. 2007. Scientific Teaching. WH Freeman and Co.

Assessment & Feedback

Evidence for what students know and can do

Low-stakes opportunities to help instructor adjust ongoing instruction to meet student needs

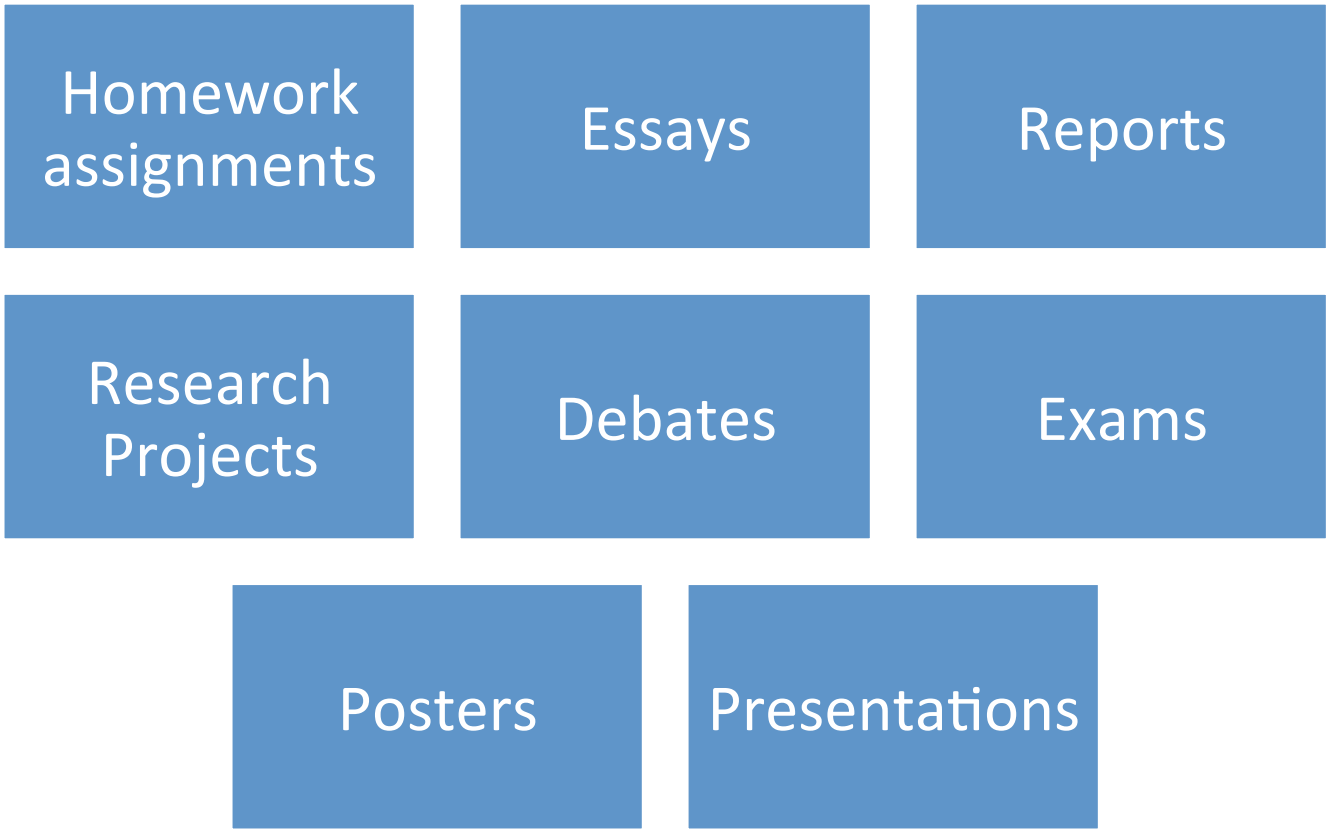
- Small group discussion Think-Pair-Share
- Concept/clicker questions (group vote/class meta-analysis)
- Student worksheets, minute papers

Opportunities for student self-assessment

- Pause and write down.
- How do you know?
- What will you do differently next time?
- What questions do you have?

Assessment & Feedback

Higher stakes assessments that may account for part of a student grade



Assessment & Feedback

"FIDElity" Feedback

Frequent — When possible give feedback daily or weekly.

Immediate — Provide feedback soon after student work is completed.

Discriminating — Clearly explain differences between high/low scoring work.

Empathy — Show compassion for the students when delivering feedback.

Adapted from Fink, 2003

Assessment & Feedback: Rubrics

"Learning increases when learners have a sense of what they are setting out to learn, a statement of explicit standards they must meet and a way of seeing what they have learned."

Loaker, Cromwell and O'Brien (1986)

Criteria	Exemplary	Good	Acceptable	Unacceptable
Organization				
Figures				
Interpretations				
…				

Rubrics improve consistency & efficiency when grading.

http://serc.carleton.edu/NAGTWorkshops/assess/rubrics.html

Reflection

What ideas from this session are potentially useful for your teaching?

Why?

Which of those ideas is likely to give you the biggest "return on investment" – i.e., have the highest impact on student learning – while still being manageable?