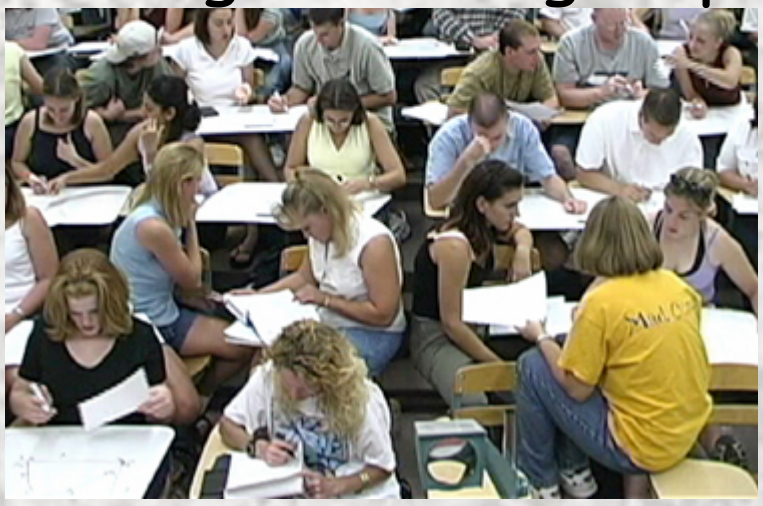
Designing and Facilitating Effective Collaborative Learning Activities

Ann Bykerk-Kauffman

California State University, Chico

Competing Paradigms of Education

Teaching-Centered	Learning-Centered
Teacher is "sage on the stage," lecturing to a class of passive note-taking students	Teacher is "guide on the side:" Students are actively engaged, often working in small groups



Assumptions About Education*

Teaching-Centered	Learning-Centered
• Content is primary and instructor owns the knowledge	• Process of learning is as important as the content learned.
• Instructor is central	• Instructor and students are partners
• Success is an individual accomplishment	• Success results from teamwork

These assumptions are debatable.

*McManis (2005) **Leaving the Lectern**

Assumptions About Education*

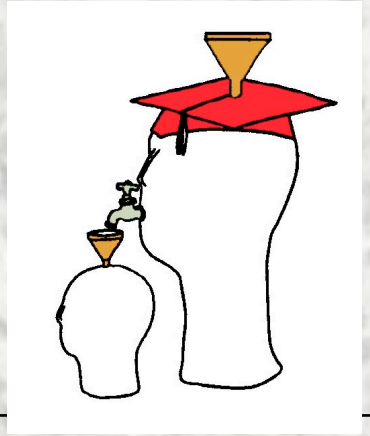
Teaching-Centered	Learning-Centered
• Students differ little from instructor	• Many students differ from instructor
• Students enter class with empty minds	• Students enter class with a perceptual framework intact
• Learning is cumulative	• Learning is a dynamic process of restructuring.

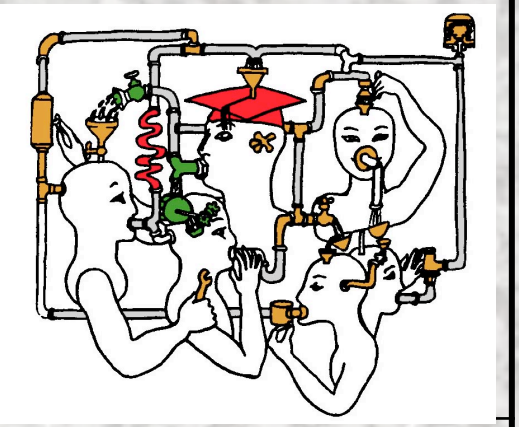
The learning-centered assumptions are more in line with reality.

*McManis (2005) **Leaving the Lectern**

Educational Goals*

Teaching-Centered	**Learning-Centered**
• Instructor transfers information to students	• Instructor creates a learning environment
• Students accumulate knowledge	• Students develop skills in constructing and using knowledge



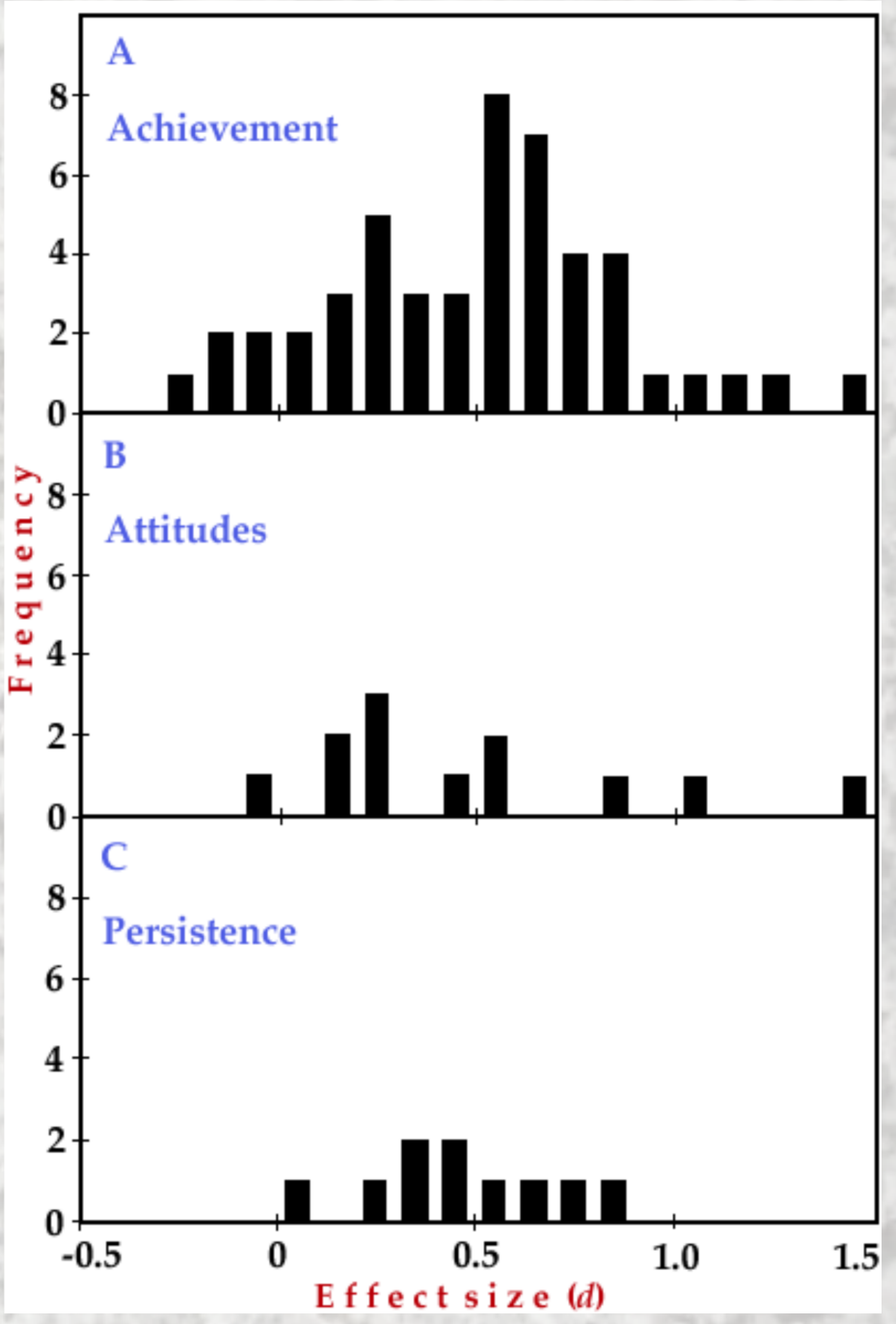


*McManis (2005) **Leaving the Lectern**

Research on Collaborative Learning

Springer, L., Stanne, M. E., and Donovan, S., 1998, Effects of cooperative learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis." (Research Monograph No. 11): University of Wisconsin-Madison, National Institute for Science Education, **Review of Educational Research**

http://www.wcer.wisc.edu/archive/Cl1/cl/resource/scismet.pdf



Research on Collaborative Learning

Meta-analysis of 39 studies of collaborative learning in post-secondary STEM courses.

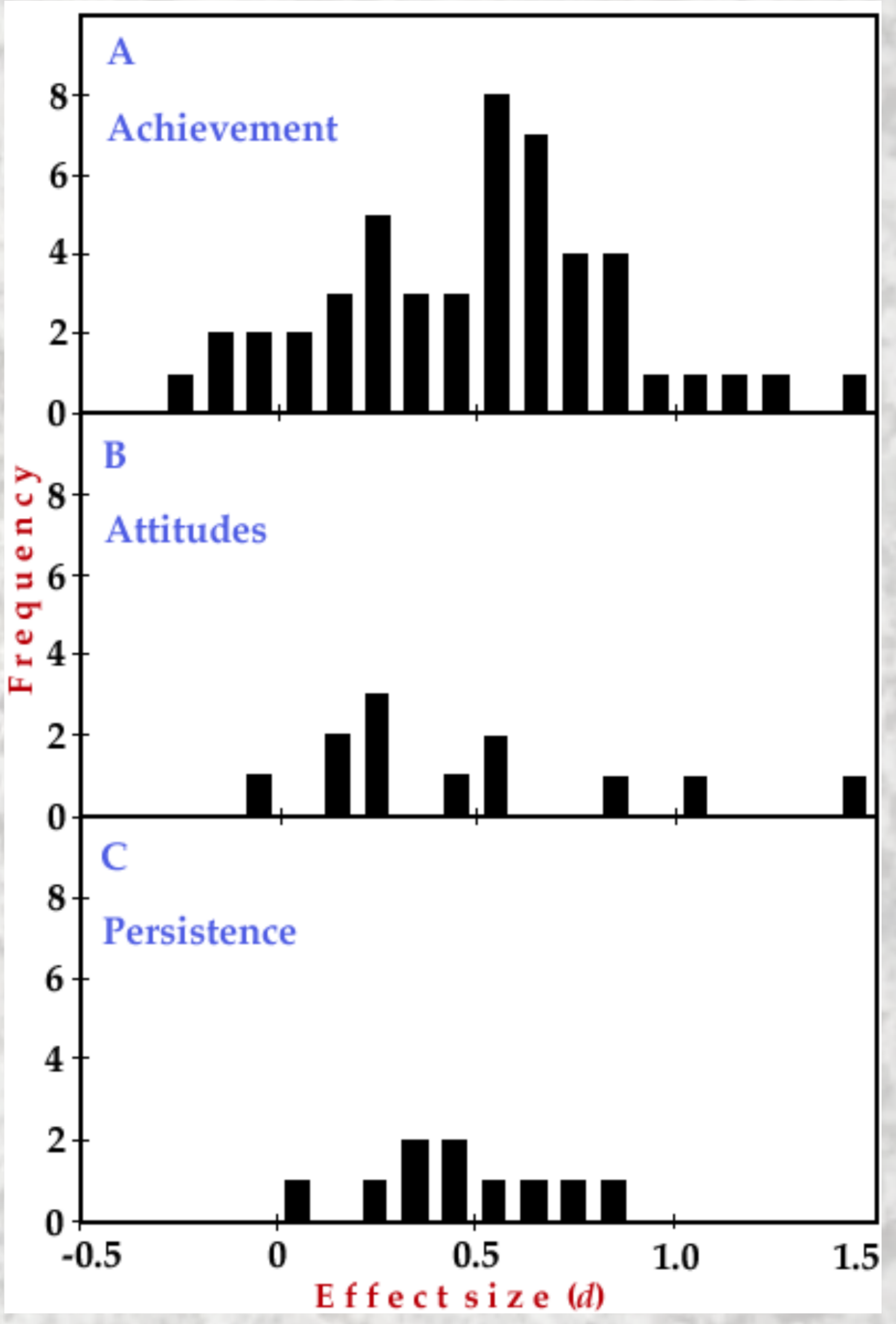
$$d = \frac{\text{mean}_1 - \text{mean}_2}{\sqrt{(SD_1^{\,2} - SD_2^{\,2})/2}}$$

d = effect size

SD = standard deviation

A d of 0.5 is considered a medium effect size.

http://www.wcer.wisc.edu/archive/Cl1/cl/resource/scismet.pdf



Collaborative Learning Structure: Think-Pair-Share

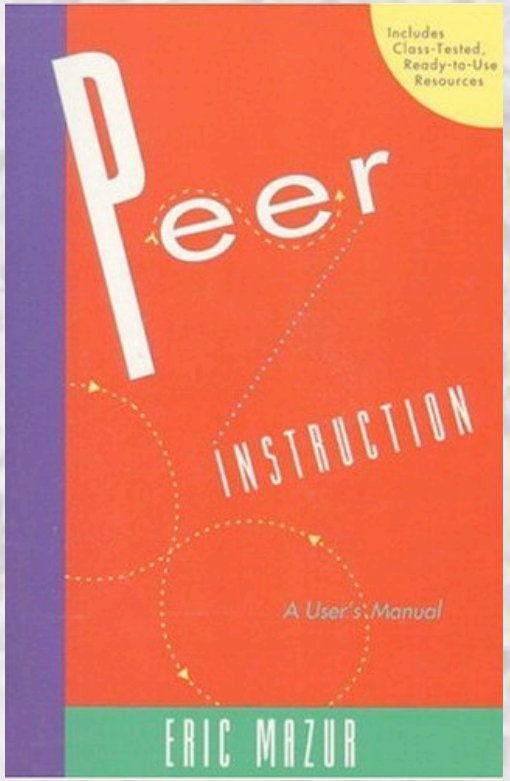
- Reflect on your experience with teaching-centered and learning-centered classes.
  - What worked for you? Why?
  - What didn't work for you? Why not?
- Pair up: discuss your answers.

Examples of Effective Collaborative Learning Structures

- Think-Pair-Share
- Peer Teaching (using clickers)
- Guided-Discovery Labs
- Interteaching
- Jigsaw

Peer Instruction

- Lectures are interspersed with conceptual multiple-choice questions (**ConcepTests**), designed to expose common difficulties in understanding the material.
  - Students answer the question, using clickers (1-2 minutes).
  - Instructor displays the distribution of answers.
  - Students discuss their answers in small groups (2-3 minutes).
  - Students answer the question again.

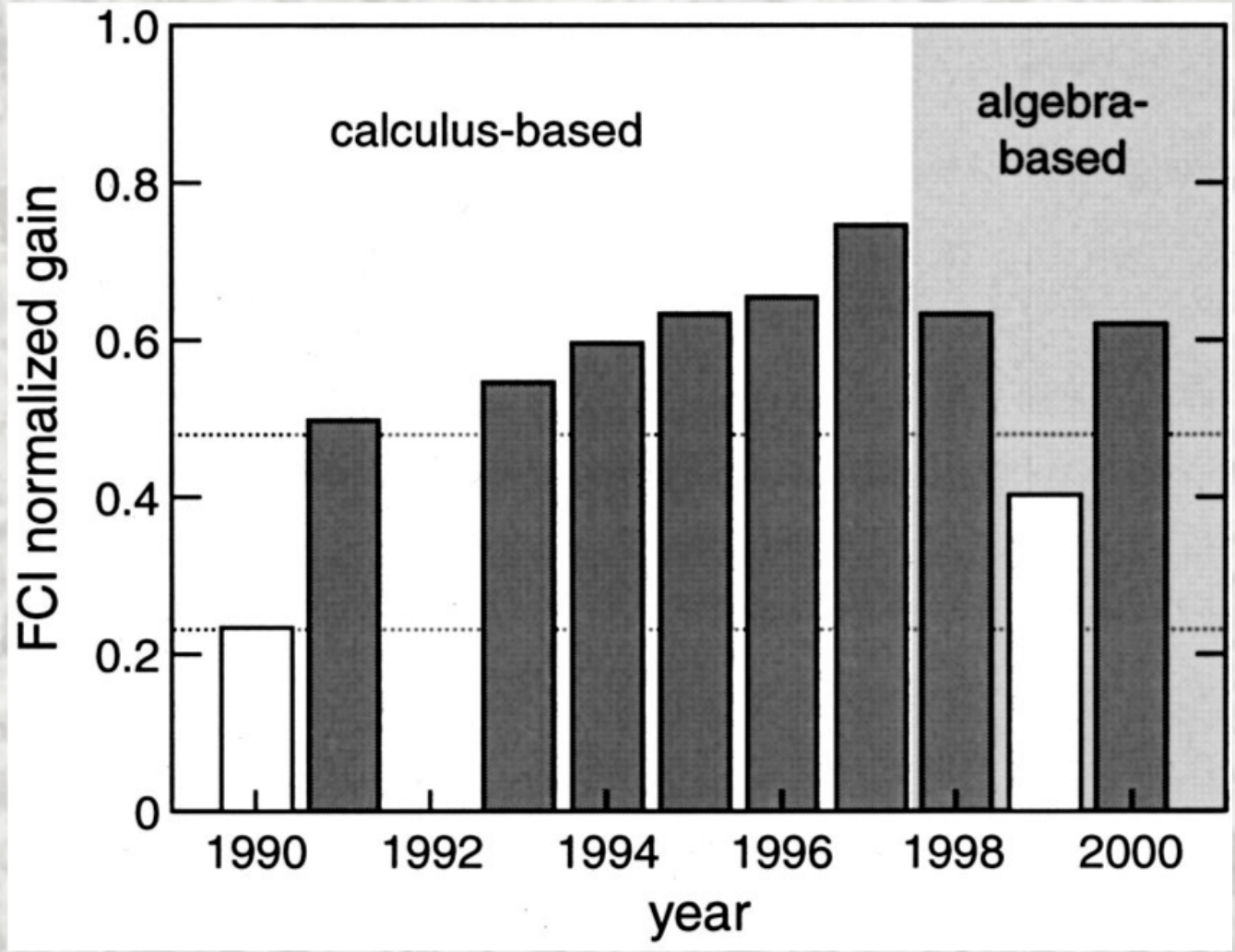


ISBN 0-13-565441-6

http://mazur-www.harvard.edu/

Effectiveness of Peer Instruction

(Crouch & Mazur, 2001, Am. J. Phys)



Traditional

Peer Instruction

FCI = Force Concept Inventory

Where is addition of water an important cause of mantle melting?

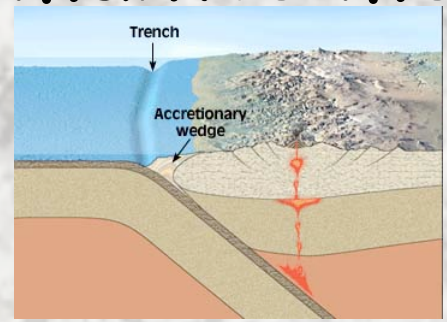
A. Subduction zones.

B. Sea-floor spreading ridges.

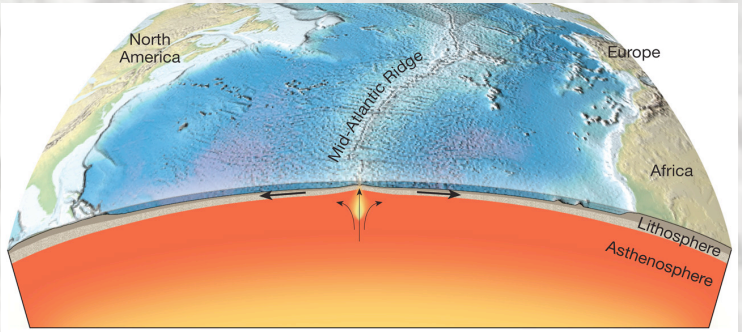
C. Rising mantle plumes (hot spots).

D. All of the above.

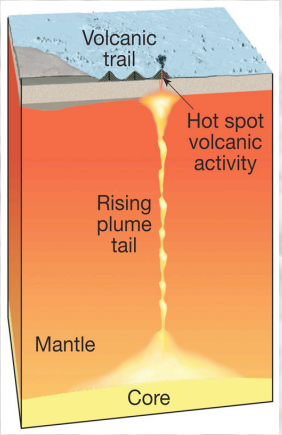
E. None of the above.



A



B



C

How clickers work

- Students buy the clickers ($30-60)
- You get the software and receiver free

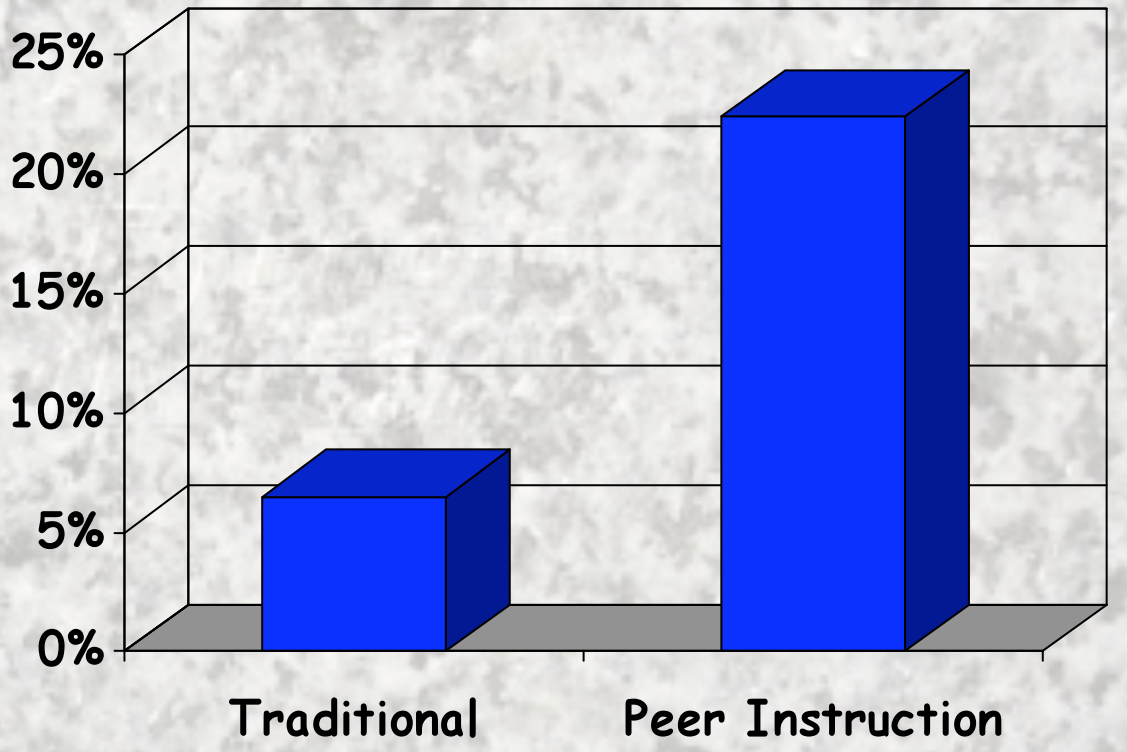
http://www.h-itt.com/

http://www.iclicker.com/

Effectiveness of Peer Instruction in Introductory Geology

(unpublished CSU Chico Data from Fall 2007)

Normalized Gain on the Geoscience Concept Inventory



$$\text{Normalized Gain} = \frac{\text{PostCourse Score} - \text{PreCourseScore}}{100\% - \text{PreCourseScore}}$$

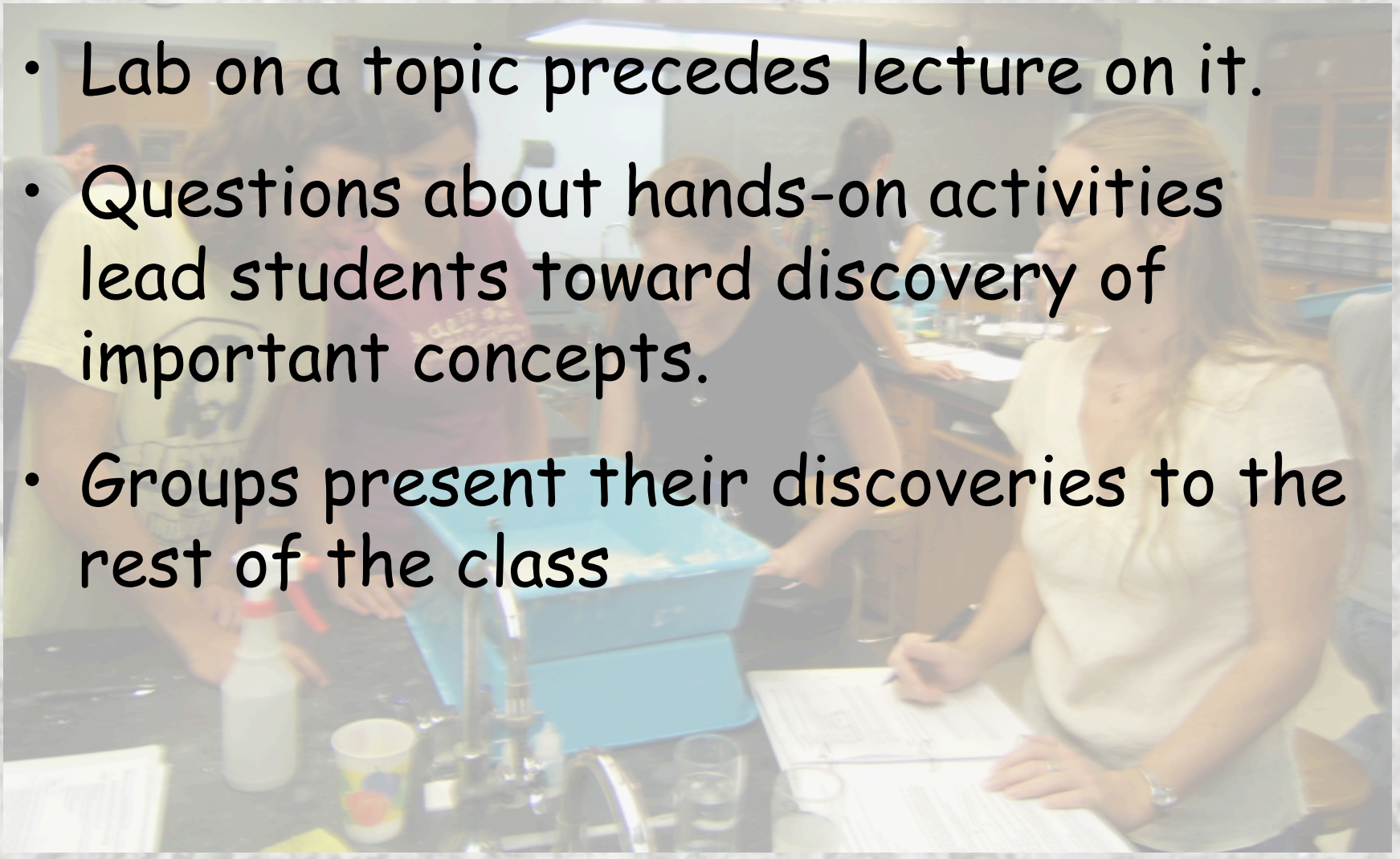
The most difficult part of peer instruction is coming up with good conceptual questions.

For ideas, go to

serc.carleton.edu

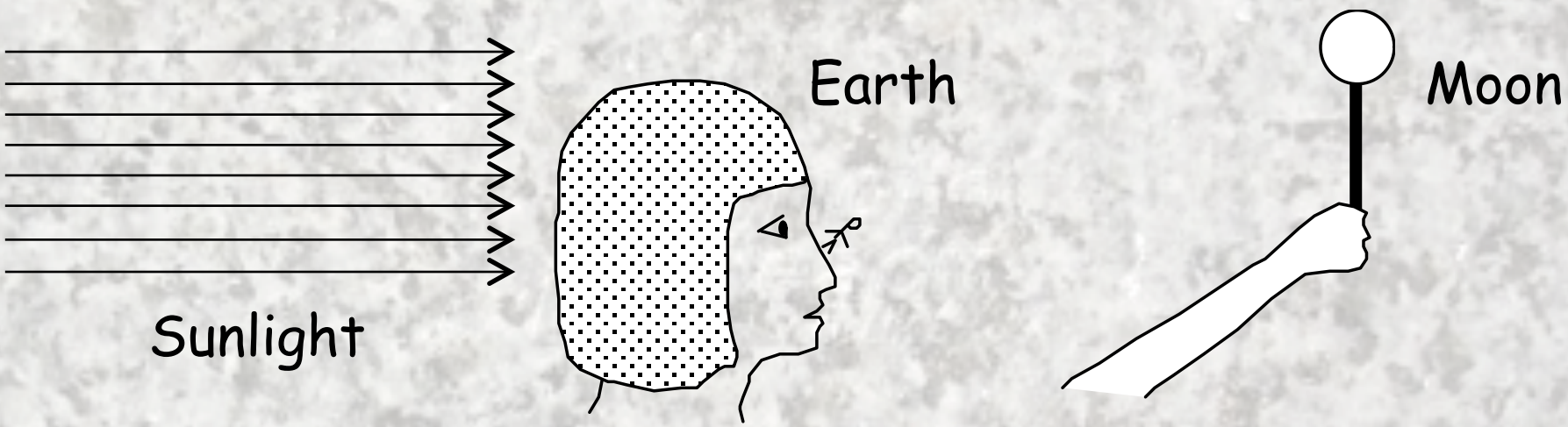
and search for "conceptests."

Guided-Discovery Lab Activities



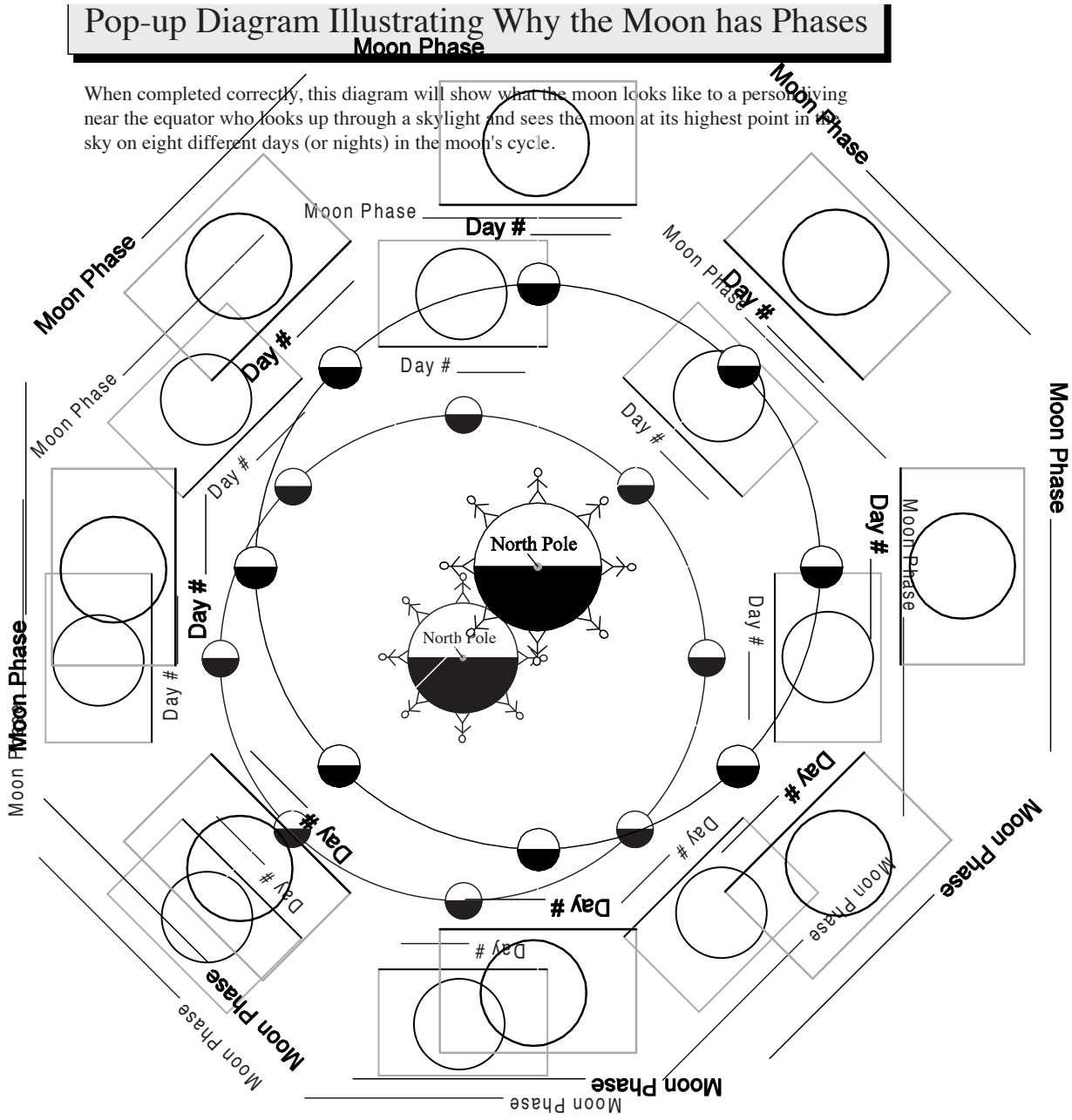
- Lab on a topic precedes lecture on it.
- Questions about hands-on activities lead students toward discovery of important concepts.
- Groups present their discoveries to the rest of the class

In a room lit by only one light bulb, hold a polystyrene ball on a pencil as shown.



Slowly rotate your body, keeping the "moon" in front of you and watching as various parts of the white ball become lit and/or shaded.

Complete the diagram, showing how the moon looks from Earth in various locations on its orbit.

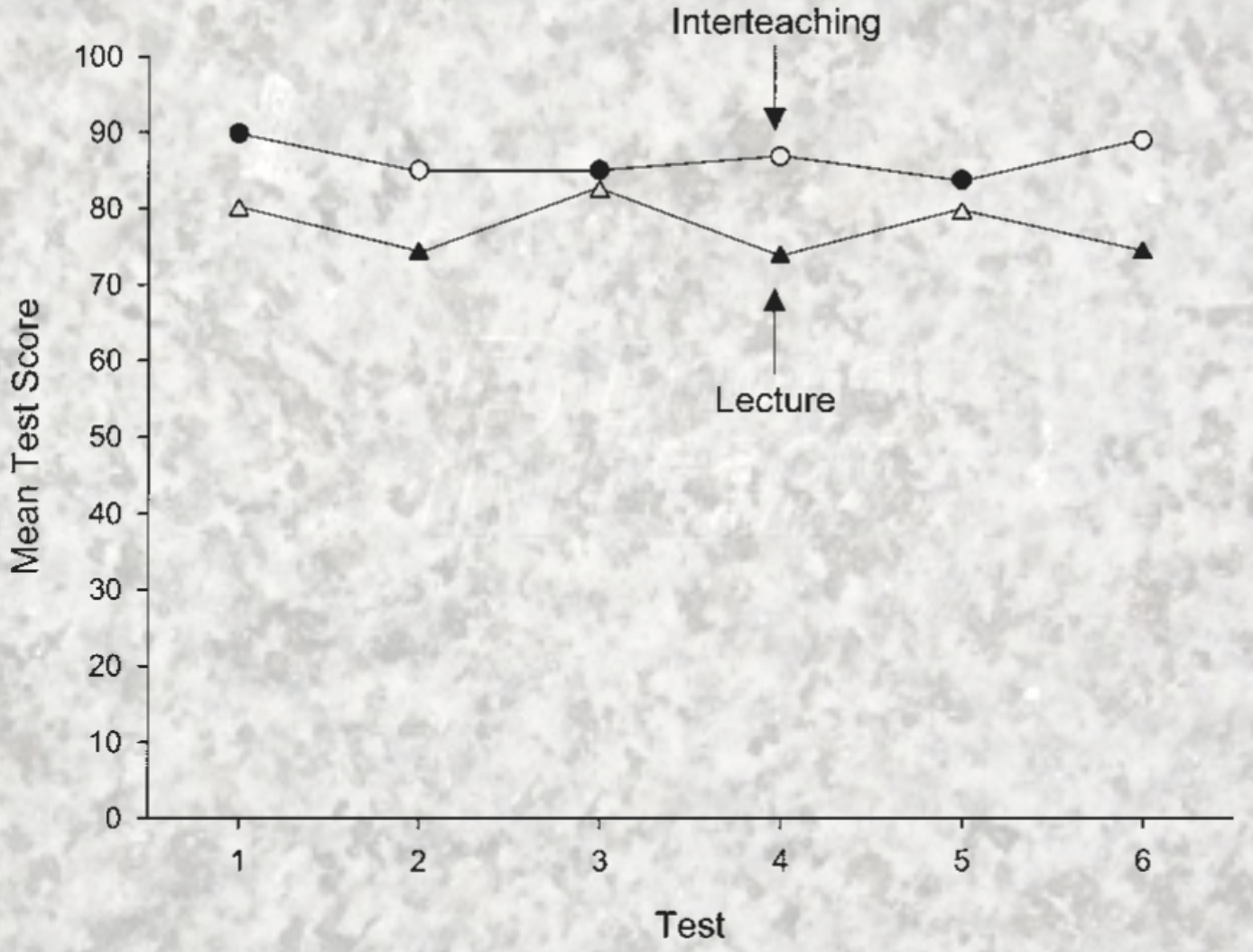


Interteaching*

- Instructor writes a prep-guide: questions designed to guide students through a reading assignment.
- Students write notes on the reading with pre-guide questions in mind.
- In class, students work in groups of 2-3 to compose answers to questions.
- Instructor bases next lecture on problems students had with questions.

*Boyce, T. E., & Hineline, P. N., 2002, Interteaching: A strategy for enhancing the user-friendliness of behavioral arrangements in the college classroom: The Behavior Analyst, v. 25, p. 215–226.

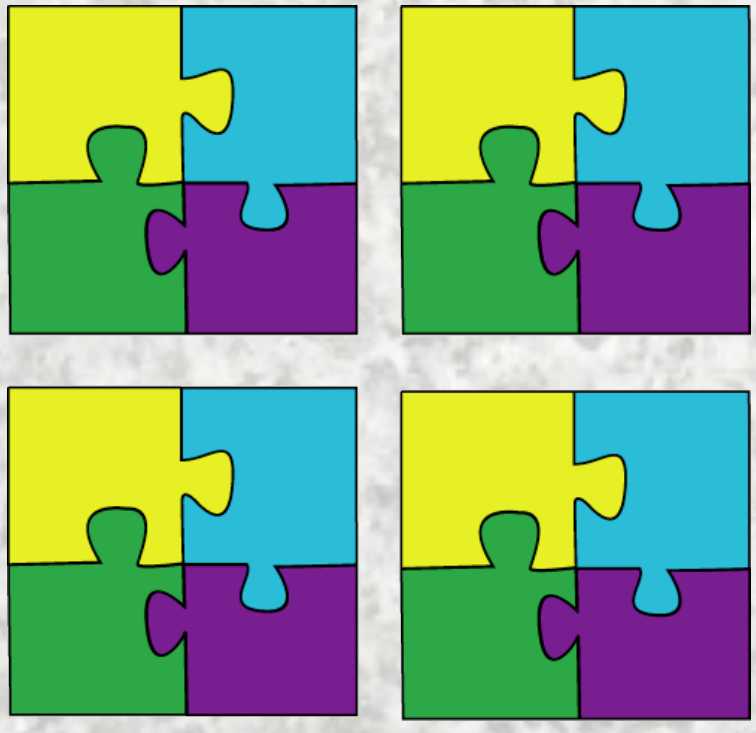
Effectiveness of Interteaching



Saville, B.K., Zinn, T.E., Neef, N.A., Van Norman, R., and Ferreri, S.J., 2006, A comparison of interteaching and lecture in the college classroom: Journal of Applied Behavior Analysis, v. 39, p. 49-61 .

The Jigsaw Structure*

Groups

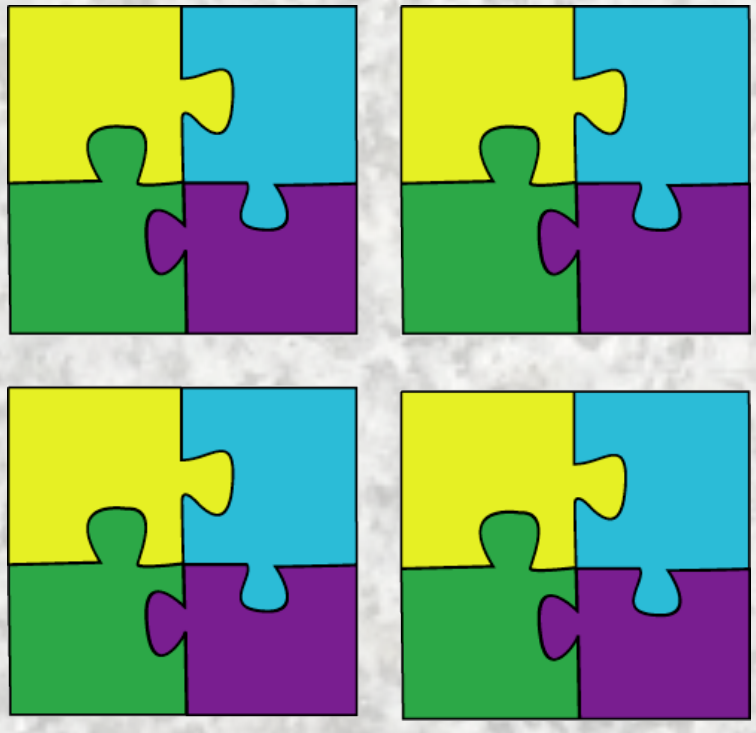


1. Design an assignment with multiple related but independent aspects, one for each group member.

* Aronson, E., Blaney, N., Stephan, C., Sikes, J., and Snapp, M. (1978). **The jigsaw classroom.**, Sage Publications.

The Jigsaw Structure*

Groups



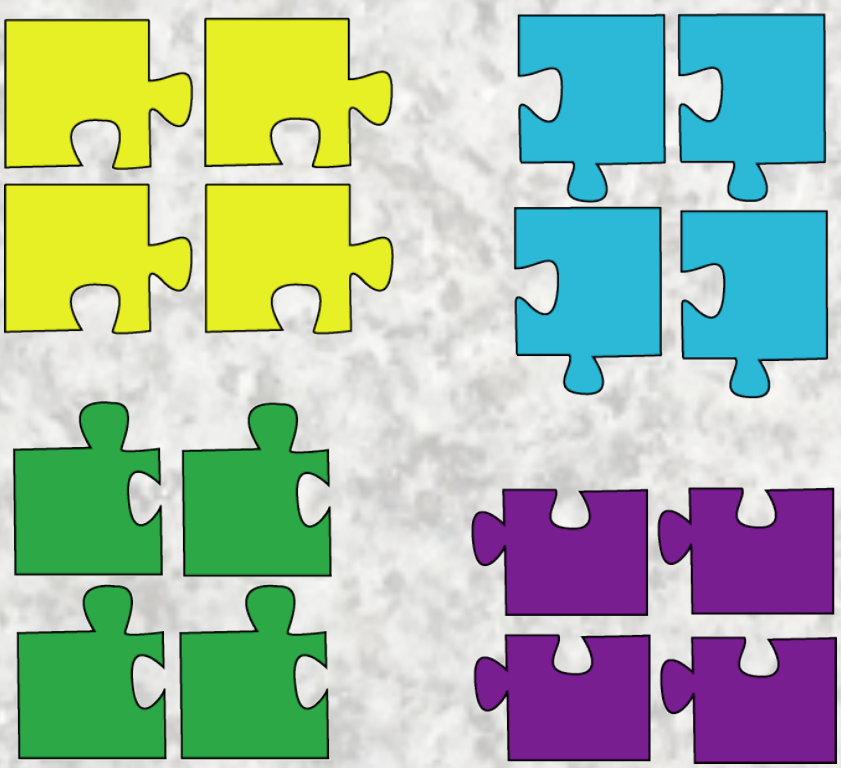
Example:

- Variations in time of moon rise and set.
- Tilt of lit part of moon relative to horizon.
- Maximum altitude of moon vs. phase and season.
- Maximum altitude of moon vs. astronomical place.

* Aronson, E., Blaney, N., Stephan, C., Sikes, J., and Snapp, M. (1978). **The jigsaw classroom.**, Sage Publications.

The Jigsaw Structure*

Teams

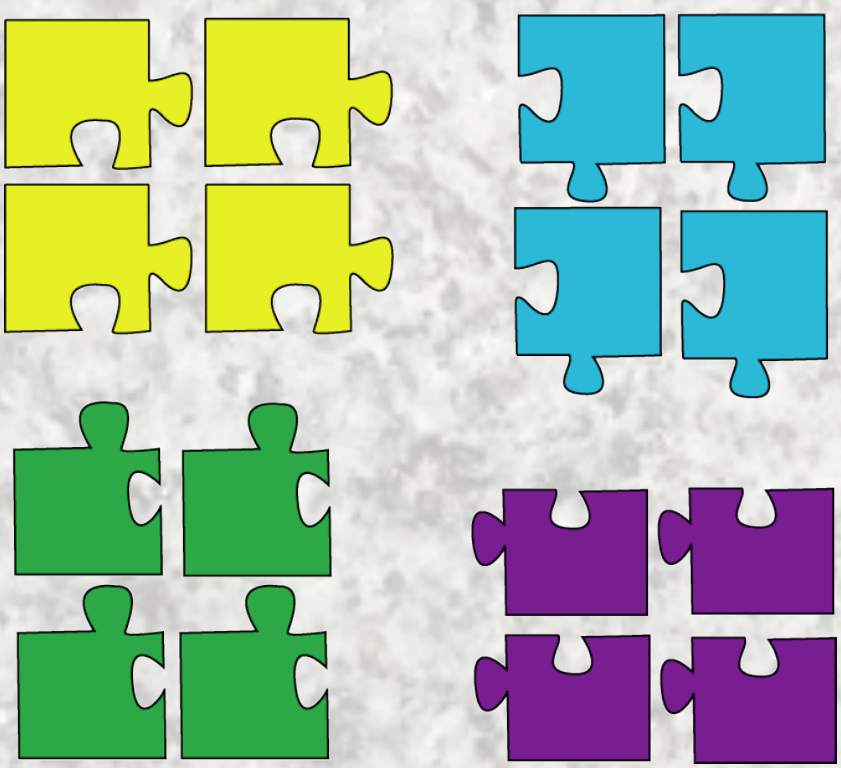


2. Students responsible for the same aspect of the project join together and form teams.

* Aronson, E., Blaney, N., Stephan, C., Sikes, J., and Snapp, M. (1978). **The jigsaw classroom.**, Sage Publications.

The Jigsaw Structure*

Teams



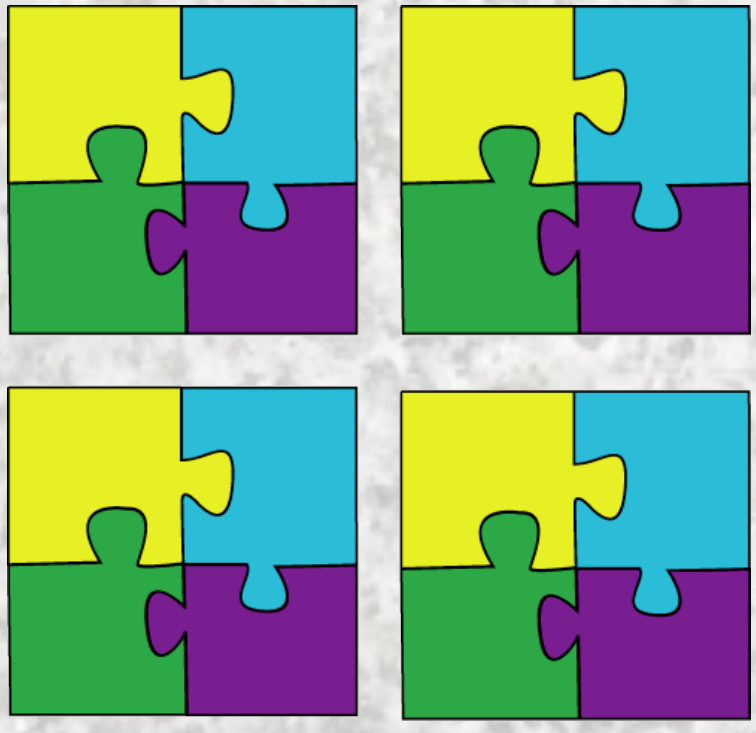
Teams work to

- Master the concepts in their aspect of the project.
- Develop ways to teach their aspect to their groups.

* Aronson, E., Blaney, N., Stephan, C., Sikes, J., and Snapp, M. (1978). **The jigsaw classroom.**, Sage Publications.

The Jigsaw Structure*

Groups



3. Groups reunite; each member teaches his/her aspect of the project to the rest of the group.

* Aronson, E., Blaney, N., Stephan, C., Sikes, J., and Snapp, M. (1978). **The jigsaw classroom.**, Sage Publications.

Give Collaborative Learning a try!