Topics for lessons are on each table.
Please sit at a table with a topic for which you could see yourself designing a lesson in an entry-level course.

- Climate change
- Earth resources
- Earthquakes
- Geochemical cycling
- Mass extinctions
- Formation/age of the Earth
- Thunderstorms
- River floods
- Mountain belts
- Planets

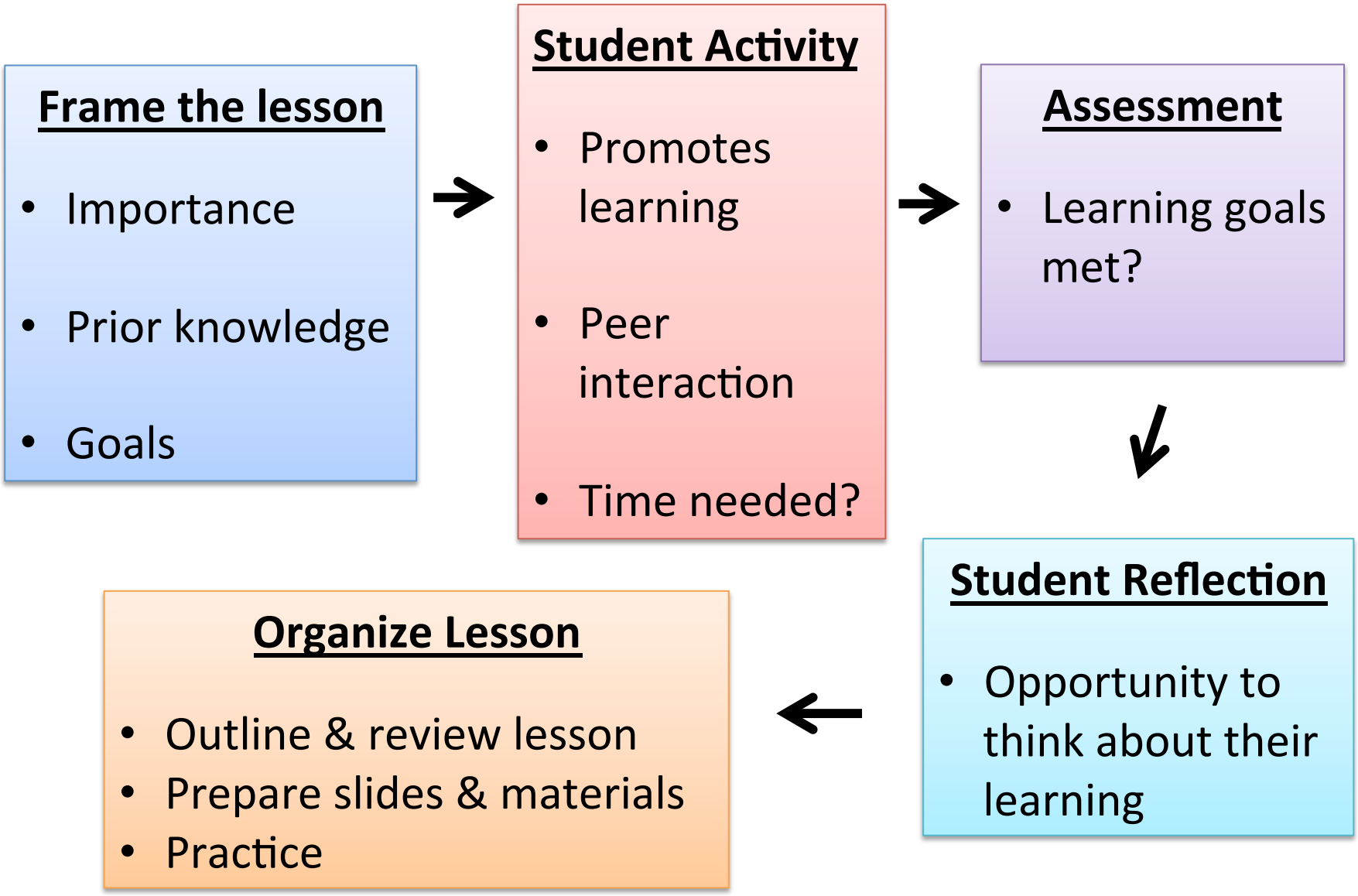
Lesson Design: Preparing for a Class Period

Rachel Beane, Josh Galster and Cynthia Hall
With material from Heather Macdonald and David McConnell

- Elements of lesson design
- *Lesson planning activity*
- Framework for review

What did your favorite teachers include in their lessons that helped you learn?

One Approach to Lesson Design



1. Start your planning

- **Importance**: Why should students care?
- **Prior knowledge**: What knowledge do students bring to this lesson (from this course and from other experiences)?
- **Goals**: What should students know/be able to do by the end of the lesson?

Example verbs for writing lesson goals

(Students will be able to…)

	Cognitive Dimension (version of Bloom's Taxonomy)					
Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Facts	list	paraphrase	classify	outline	rank	categorize
Concepts	recall	explain	demon-strate	contrast	criticize	modify
Processes	outline	estimate	produce	diagram	defend	design
Procedures	reproduce	give an example	relate	identify	critique	plan
Principles	state	convert	solve	differentiate	conclude	revise
Metacognitive	use	interpret	discover	infer	predict	actualize

Table from http://www.nwlink.com/~donclark/hrd/bloom.html using Clark & Chopeta (2004) and Clark & Mayer (2007).

2. Continue your planning

- What **activities** will be in your lesson?
- How will you **assess** student learning?

Examples of Interactive Activities

- Project
- Gallery Walk
- Think-pair-share
- Lecture Tutorial
- Debate
- Jigsaw
- Concept Map
- Discussion
- ConcepTest (group)
- …

Gallery Walk introducing REE in 30 person, non-majors course.
Photo by Kevin Travers, Bowdoin College.

http://serc.carleton.edu/NAGTWorkshops/earlycareer/teaching/toolkit.html

3. Outline your lesson

- Beginning – “Hook”
- Middle – interactive activity
- End – students discuss/synthesize/reflect

4. Review your lesson plan

Will students/learners…

- see a **clear framework**?
- use & be assessed on **prior knowledge**?
- investigate/explore science through an **activity**?
- **interact** with each other?
- **reflect** on their learning?
- **be listened to** and **responded to**?

Review your lesson plan

- Is the **framework** clear to students?
  (Question of day, outline, learning outcomes, concept map …)
- Does the lesson use/assess **prior knowledge**?
  (brainstorm, everyday experiences, ConcepTest, previous lessons …)
- Is there an **activity** that allows students to explore or investigate?
  (predict, hypothesize, assess, represent/interpret data…)
- Will students **Interact with each other** about course content?
  (Think-pair-share, gallery walk, jigsaw …)
- Are students asked to **reflect** on their learning?
  (minute paper, concept map, how do you know? …)
- Will you have an opportunity to **listen & respond**?
  (question-response, listening to discussions, ConceptTests …)

Class Prep as the Blob

- Class prep will expand to fill whatever time you allow it: one more image, one more example…
  - Limit prep to a set time.
- Try not to over-prepare: have confidence!
  - Allows for creative class discussions and unexpected directions
  - Including interactive exercises easier than lecturing
- Powerpoint is not always your friend

Sample lecture notes on surface runoff

- Runoff vs. infiltration over time curves: when does runoff happen?
- Infiltration rates constant?

- Runoff
- Infiltration
- Throughflow
- Baseflow

- Factors affecting permeability
- AMC
- Time since last rainfall, Frozen ground, Clays, Vegetation, Fires, Slope, Hydrophilic substances (fire, clays)

- Sheetwash/overland flow
- Rills
- Channelized flow

- Erosion: movement of material
- Bed Shear stress depends on depth and slope
- $\tau = \rho g h S$

- Positive feedback cycle of channel development

- Discharge: volume per time
- Different ways to measure discharge
- A x V = Q
- Velocity profile (0.6 * d)

- Smaller and smaller boxes

- Hydrograph: depth or discharge over time
- Basic hydrograph and rain
- Lag time, Precip
- Baseflow
- Rising limb
- Falling limb
- Groundwater recession (linear portion of hydrograph)

- Effect of land use change

- Baseflow and peakflow

5’ Paper: *Reflecting on Lesson Design*

- What is the most important concept that you learned?
- What aspect of this session was most helpful for your learning?
- How will you approach planning for your next class?