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
- Formation/age of the Earth
- Geochemical cycling
- Mass extinctions
- Thunderstorms

You won't have time to create a lesson to cover the whole topic today. Consider material suitable for a single lecture.

Designing an Effective Lesson

Heather Macdonald and David McConnell

(based on a presentation by R Beane and H Macdonald)

Lesson Design

- Approaches to preparing to teach a lesson
- Key elements of lesson design
- Lesson planning activities
- Framework for review

Imagine the future

The syllabus gives ABC as the topic of the day.

How will you prepare for that class?

One example of preparing for class

Lesson Framework

- Why is the topic important to the student, course?
- What are the learning goals for this lesson? (What will students know and be able to do by the end of class?)
- What prior knowledge is needed for this lesson?

Student Activity

- What will the students do during class to help them learn the material?
- How will they interact with their peers?
- How much time will they need to complete tasks?

Instructor Assessment

- What assessments can I use to determine if most students have met the learning goals?
- Am I scaffolding learning to support the application of higher order thinking skills?

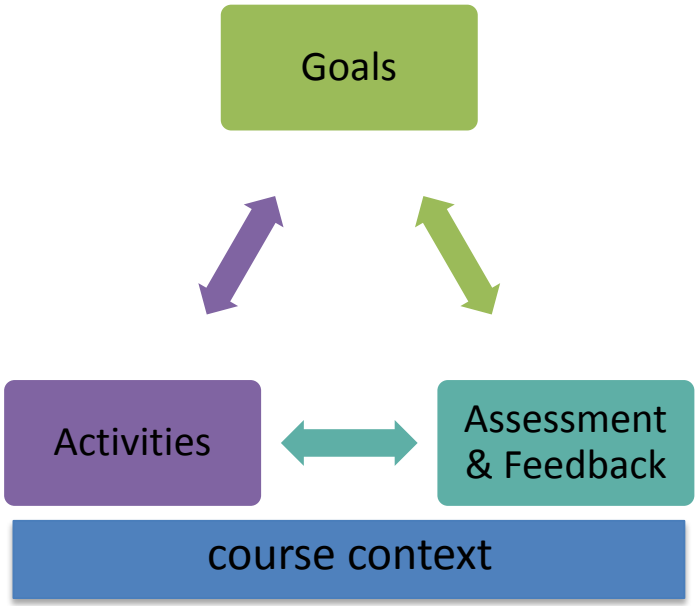
Student Reflection

- What activity can I use to give students an opportunity to reflect on their learning?

Lesson Design

- Organize the lesson, determine what content students need to obtain outside of class.
- Prepare slides and other materials that can be made available for student review.
- Walk through the presentation to make sure it flows easily.

Goals, activities, assessment & feedback



What will students do?

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

(NRC, 1999 *How People Learn*)

Planning Your Lesson 1

Start your planning

- Why is this topic important to the student and to the course?
- What are your learning goals? (What do you want the students to know and be able to do by the end of the lesson?)

Planning Your Lesson 2

Continue your planning

- What are some possibilities for activities you might have students do?
- What are some possibilities for how you will learn what the students have learned?

Planning Your Lesson 3

Outline your lesson

- Beginning – Engage students, connect to what they know, set the stage for the lesson
- Middle – Include an activity that involves students doing science
- End – Leave time for students to discuss, synthesize, and/or reflect

Planning Your Lesson 4

Review your lesson plan

- Is the **framework** clear to students?
- Does the lesson use/assess **prior knowledge**?
- Is there an **activity** in which students explore or investigate?
- Will students **interact with each other** about course content?
- Will you have an opportunity to **listen** to students?
- Are students asked to **reflect** on their learning?

Reviewing your Lesson Plan

- Is the **framework** clear to students?
  (Question of day, outline, learning outcomes, concept map …)
- Does the lesson use/assess **prior knowledge**?
  (ConcepTest, everyday experiences, 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)
- Will you have an opportunity to **listen** to students?
  (question-response, listening to group discussions, …)
- Are students asked to **reflect** on their learning?
  (minute paper, knowledge survey, how do you know?, concept map)

Reflecting on Lesson Design

- What is the most important concept that you learned about lesson design?

- What aspect of this session was most helpful in your learning?

- How will you approach planning for your next class?

CLASSROOM OBSERVATION

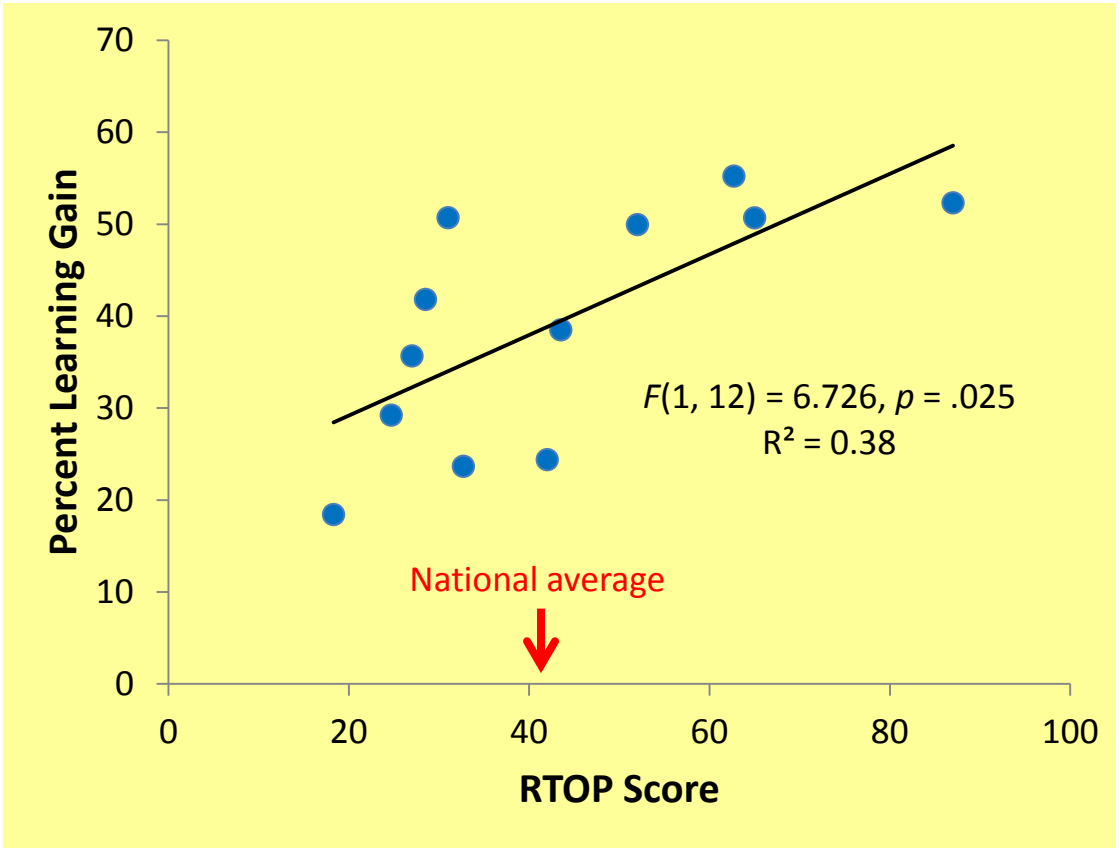
Reformed Teaching Observation Protocol (RTOP)

- RTOP has 5 categories:
  - Lesson Design & Implementation (What the teacher intended to do)
  - Propositional Knowledge (What the Teacher knows)
  - Procedural Knowledge (What the students did)
  - Classroom Culture (Student-Student Interactions)
  - Classroom Culture (Student/Teacher Relationships)
- 0-4 for each item, total of 100 possible points
- High RTOP scores → a more reformed classroom (more student activity during class)

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

Sawada, D., Turley, J., Falconer, K., Benford, R., and Bloom, I., 2002, School Science and Mathematics, v. 102, p.245-252.

Course Context



The more student-centered the classroom (↑RTOP), the greater the learning gains

38% of the variance in student learning gains are explained by the nature of instruction in the classroom

[1]PCAST recommendation #1

Catalyze widespread adoption of empirically validated teaching practices.

[1]President's Council of Advisors on Science and Technology: Engage to Excel report (2012)