Designing Effective and Innovative Courses

A Practical Strategy

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How are courses commonly designed?

- Make list of content items important to coverage of the field
- Develop syllabus by organizing items into topical outline
- Flesh out topical items in lectures, recitations, discussions, labs
- Test knowledge learned in course

What's missing?

- Consideration of what *your* students need or could use, particularly after the course is over
- Articulation of goals beyond content/coverage goals
- Focus on student learning and problem solving rather than on coverage of material by the instructor

Why build a course around goals for students?

- "It dawned on me about two weeks into the first year that it was not teaching that was taking place in the classroom, but learning."

Pop star Sting, reflecting upon his early career as a teacher

Why build a course around goals for students?

- Teaching is commonly viewed as being teacher-centered.
- Reinforced by the teaching evaluation process
- Commonly reinforced by how we think of our courses: "*I want to expose my students to….*" or "*I want to teach my students about…*" or "*I want to show students that…*"

Why build a course around goals for students?

- We can't do a student's learning for him/her
- Exposure does not guarantee learning
- Students learn when they are actively engaged in practice, application, and problem-solving (NRC *How People Learn)*.

Contrast between professor- and student-focused approaches

- Professor-focused approach focuses on:
  - Content coverage
  - Ability of professor to present content
- Student-focused approach focuses on:
  - Developing students' abilities to solve problems in the discipline and apply what they have learned to future tasks.
  - Provides practice in analysis using content.
  - Content still important! But goes beyond.

Improving student learning

- In an *effective* course:
  - Students learn significant and appropriate content and skills
  - Students have practice in thinking for themselves and solving problems in the discipline
  - Students leave the course prepared to use their knowledge and skills in the future

Impact on course design

- Different approach requires a different course.
- If you want students to be good at something, they must practice; therefore goals drive both course design and assessment.
- A course should give students first hand experience in what we want them to be able to do when they are done with our courses.

Changing focus from coverage to achieving overarching goals

- Example from a bio course
  - Survey of topics in general biology

    Vs.
  - Enabling students to evaluate claims in the popular press *or* seek out and evaluate information *or* make informed decisions about issues involving genetically-engineered crops, stem cells, DNA testing, HIV AIDS, etc.

Setting overarching course goals for students

- What do I want my students to be able to ***do*** when they are done with my course?"
  - Students will *use* their strong background in order to ____

    rather than just
  - Students will *have* a strong background in ____
- What value have I added to their future abilities as a result of having taken my course?

Figuring out what you want students to be able to do

- What sorts of things do *you* do simply because you are a professional in your discipline??
  - I use the geologic record to reconstruct the past and to predict the future.
  - I look at houses on floodplains, and wonder how people could be so stupid
  - I hear the latest news from Mars and say, well that must mean that….

Figuring out what you want students to be able to do

- Physicist: predict outcomes based on calculations from physics principles
- Art historian: assess works of art
- Historian: interpret historical account in light of the source of information
- English prof: critical reading of prose/ poetry

Figuring out what you want students to be able to do

- Your course should enable your students, at appropriate level, to *do* what you do in your discipline, not just expose them to what you know.
- Start by answering the question
  - In context of general course topic, what do *you* do? What does analyze, evaluate, etc. involve?
  - Alternatively, what is unique about your world view/the view of your discipline??

Why are goals important?

- If you want students to be good at something, they must practice; therefore the goals should drive both course design and assessment.

Accomplishing Goals

- How will you get them there?
  - Neither fair nor effective to teach them *about* related topics during the semester and then ask them to pull it all together at the end.
  - What will you do to give them practice (build their abilities relative to the goal, not just their knowledge base)?

Translating goals into a course

- New environmental geo course
- Goal: students will be able to research and evaluate news reports of a natural disaster and communicate their analyses to someone else
- What content to choose?

Be able to research and evaluate news reports of a natural disaster and communicate analyses to someone else

- Instructor #1 chose four specific disasters as content topics
  - 1973 Susquehanna flood
  - Landsliding in coastal California
  - Mt. St. Helens
  - Armenia earthquake

Be able to research and evaluate news reports of a natural disaster and communicate analyses to someone else

- Significant content coverage, but goes beyond reiterative content mastery
- Goal is addressed in each topic
- Enables students to have repeated practice toward goals with increasing independence
- More effective for students

Be able to research and evaluate news reports of a natural disaster and communicate analyses to someone else

- Instructor #2 chose four themes as content topics
  - Impact of hurricanes on building codes and insurance
  - Perception and reality of fire damage on the environment
  - Mitigating the effects of volcanic eruptions
  - Geologic and sociologic realities of earthquake prediction

Be able to research and evaluate news reports of a natural disaster and communicate analyses to someone else

- Instructor #3 chose to focus on a historical survey of natural disasters in Vermont
  - Historical record of flooding in NW Vermont
  - 1983 landsliding
  - 2-3 other places in Vermont that have had natural disasters of different types.

Goals and content topics unite to provide course framework

- Previous example
  - Same goals.
  - Different content topics mean that each course will be different.
  - Choice of content topics drives how the instructor will implement the course.
  - Students will receive different kinds of practice during the course even though the overall goals are the same.

Goals and content topics unite to provide course framework

- How about a different goal for the same hazards course?
  - Students should be able to evaluate and predict the influence of climate, hydrology, biology, and geology on the severity of a natural disaster.
  - Could we use the same content topics? Yes!
  - How would the courses be different? In the activities developed and the type of practice students receive!!

Intersection of context, goals, and content

- Research & evaluate news report or evaluate and predict influence of climate, hydro, geo, bio on the severity of a natural hazard?
- Which one makes most sense for who *your* students are and what they need?
- Which content topics make the most sense for *your* students, your setting, your experience, your students' futures?

Integrating content coverage and practice toward goals

- Geology and Development of Modern Africa
- Not a "Geology of Africa" course
- Primary goal: students will be able to analyze the underlying influence of geology on human events
- Context is Africa, although goal is more general

Primary goal: students will be able to analyze the underlying influence of geology on human events

- Content topic #1: influence of climate change on prehistoric settlement patterns in North Africa
- Imbedded content items
  - Geologic content knowledge: ^{14}C dating, fossils, lacustrine sedimentation, stratigraphic columns, using sedimentary rocks to interpret paleoenvironments, geologic time scale,….

Primary goal: students will be able to analyze the underlying influence of geology on human events

- Content topic #2: influence of development of East African Rift on hominid evolution
- Imbedded content items
  - Geologic content knowledge: formation and evolution of continental rifts, radiometirc dating, rift volcanisms, stratigraphic columns, fossils, using sedimentary rocks to interpret paleoenvironments, geologic time scale, fluvial and alluvial processes, faulting, geologic history of East Africa, evolution

Can you still cover essential content?

- A course that is not a survey course can be content-rich
- Courses with depth rather than breadth are viable alternative
- Topic coverage doesn't have to be linear
- Can meet content expectations for subsequent courses if topics selected carefully

Reorganizing existing content around a theme

- Wendy Panero's Course *Mineralogy* at SUNY Oswego
- Required course for geo majors
- Goal: Students will be able to synthesize mineralogical data (visual inspection, petrographic microscopy, XRD and SEM/EDS) to address specific geological problems.

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- Previous organization
  - Around topics such as crystal chemistry, Miller indices, systematic mineralogy, lattice structures, space groups, etc.
- New organization
  - Core
  - Mantle
  - Crust
- Emphasis on *student* practice toward goal

Goal: synthesize mineralogical data (visual inspection, petrographic microscopy, XRD and SEM/EDS) to address specific geological problems.

- Same topics revisited with increasing complexity in each course chunk
- Enables students to have repeated practice toward goals with increasing independence
- Same overall content but progress toward goals threaded throughout the course
- More effective for students

A case study approach

- Persa Batra's course on the Human Dimensions of Climate Change at Mt. Holyoke College
- Goals: students will be able to:
  - analyze the characteristics of past societies that made them vulnerable to climate change
  - predict what modern regions are most vulnerable to future climate change
  - formulate strategies to reduce these vulnerabilities.

Goals: students will be able to analyze the characteristics of past societies that made them vulnerable to climate change; predict future vulnerability; formulate strategies to reduce vulnerability.

- Case study approach
  - Neolithic Kebaran people of southwest Asia
  - Akkadians of ancient Mesopotamia
  - Classic Maya
  - Iceland, France, England and Ireland during the Little Ice Age
  - India during the 1876-78 famine
- Emphasis on *student* practice, not just hearing instructor talk about it.

A "just in time" approach

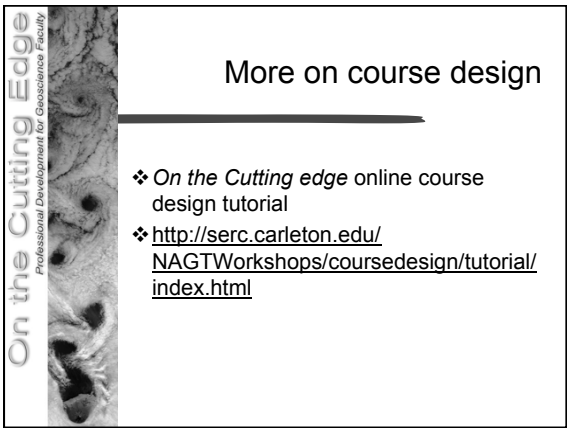
- Linda Reinen's course on Tectonics at Pomona College
- Goals:
  - Read and interpret the scientific literature: summarize and synthesize information relating to a specific topic and/or question
  - Collect and analyze data to address a scientific question (formulate a data-collection plan, collect data, identify patterns within the data, and quantify results)
  - Synthesize data collected from a variety of sources to test current tectonic models for the southern California region.

Goals: synthesize info from literature, collect & analyze data, carry out project a project

- Initial thoughts on organization
  - Long intro background section
  - Then wrap-up project
- Revised organization: ditch the long background section and integrate it "just in time"
  - Have students chip away at parts of the project over the semester
  - Don't fee compelled to "teach them everything before they can do something"

Focus on a "kind of thinking"

- Brad Hubeny's course on Historical Geology at Salem State College
- Goals:
  - When faced with a new piece of geologic information, students will be able to determine HOW we know this information and what the assumptions are in the analysis – *personal* practice threaded through all topics
  - Some "Historical Geology" goals as well



More on course design

- *On the Cutting edge* online course design tutorial
- http://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/index.html