Course design to achieve competence

Barbara Tewksbury, Hamilton College
btewksbu@hamilton.edu
Competence

- Competence is more than knowing information about a topic
- Competence involves being able to do something with what you know
Insights from Summits and surveys

Surface Processes

- Sediment deposition & erosion
  - Stream/River flow, morphology, deposition, erosion, effect of floods
  - Transport relationships (all surface processes)
  - Magnitude and frequency relationships of surficial deposits
  - Subsurface analogs
- Terrestrial and marine surface interactions
  - Biological, chemical, and physical interactions
  - Rates of chemical and physical changes
- Landscape alteration (geomorphology)
  - Surface mechanical and chemical processes
  - Karst formation
  - Glacial till and overburden thickness
- Habitability, sustaining life
  - Ties to natural hazards

Employers Summit: lists of content topics
Insights from Summits and surveys

- Employers Summit: lists of content topics
- Also what they expect students to be able to do with their content knowledge

<table>
<thead>
<tr>
<th>Skill List (A-awareness (had in class): P-proficiency (had to use/apply): M-mastery (project, etc. requiring demonstration of ability): E-expert (MS or PHD))</th>
<th>Level of Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical thinking/problem solving skills</td>
<td>P</td>
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<tr>
<td>Communicate effectively to scientists &amp; non-scientists</td>
<td>P</td>
</tr>
<tr>
<td>Readily solve problems, especially those requiring spatial and temporal (i.e. 3D and 4D) interpretations</td>
<td>M</td>
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<tr>
<td>Make inferences about Earth system from observations of natural world combined with experimentation and modeling</td>
<td>M</td>
</tr>
<tr>
<td>Work with uncertainty, non-uniqueness, incompleteness, ambiguity and indirect observations</td>
<td>M</td>
</tr>
<tr>
<td>Ability to access and integrate information from different sources and to continue to learn</td>
<td>M</td>
</tr>
</tbody>
</table>
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- Employers Summit: lists of content topics
- Also what they expect students to be able to do with their content knowledge
- What are the implications for course design?
Example related to natural hazards

- As future geoscientists, students should be able to evaluate the geologic hazards in a region, make and defend an informed analysis about land use, assess the uncertainties, and communicate their analyses to both a professional and a citizen audience.
- Could be addressed in a variety of courses across the geo curriculum.
Achieving competence

- Not effective (or fair) to teach students about topics during the semester and then expect them to pull it all together at the end.
- Students need practice to build their abilities relative to the competency goal, not just their knowledge base.
- Course design determines whether students just learn about topics or whether they become competent in using their knowledge to do something with what they have learned.
What do students need practice in?

- Example: As future geoscientists, students should be able to evaluate the geologic hazards in a region, make and defend an informed analysis about land use, assess the uncertainties, and communicate their analyses to both a professional and a citizen audience.
  - Finding, evaluating, and teaching themselves new information; collecting and analyzing data
  - Applying what they know to make/defend informed analyses, assessing uncertainties, and communicating to different audiences
  - Reflecting on competence
  - Thinking ahead to the future

- Last two – can’t just hope that students will do this on their own…..
Challenges in teaching to promote competence

“…able to evaluate the geologic hazards in a region, make/defend an informed analysis about land use, assess uncertainties, and communicate their analyses to professional and citizen audiences.”

- Focusing on content coverage isn’t enough
  - Mastery of information doesn’t confer ability to use that background
  - Content coverage does not confer competence
  - Assessing content mastery (comparatively easy) does not tell you whether students are able to use the content in ways that are important for their overall educational progress and future careers (more difficult)
Challenges in teaching to promote competence

“...able to evaluate the geologic hazards in a region, make/defend an informed analysis about land use, assess uncertainties, and communicate their analyses to professional and citizen audiences.”

- Just hearing/reading about how others engage in doing and interpreting (or how you as an instructor would engage) is not enough
  - Students need *personal* experience and practice
  - Personal practice changes thinking, allows students to grow, and prepares students for their professional futures
Challenges in teaching to promote competence

“…able to evaluate the geologic hazards in a region, make/defend an informed analysis about land use, assess uncertainties, and communicate their analyses to professional and citizen audiences.”

- Just having students doing things with what they know isn’t enough
  - Students need to *consciously* engage and reflect on what they are doing
  - Students need to *know* that they are making progress toward the goal
  - Students need to reflect on how their thinking and abilities have changed and how their evolving abilities will influence their future geoscience careers
Critical aspects of designing effective courses to promote competence

- Think beyond having students “learn about” or “be exposed to” or “understand” or “develop a strong background” in a body of content.
- Remember that competence is not just what your students know but what they learn to do with what they know.
- Think beyond the end of the course - what do students need to be able to do as future professionals?
- Frame your course around what students need to be able to do. Content will come along as part of the package.
Critical aspects of designing effective courses to promote competence

- Personal practice by students is critical – thread practice throughout the course (not just one sidecar module or single culminating project) to help students make effective progress toward competence
- Reflection is critical - integrate opportunities for students to reflect on and evaluate progress in their abilities, including across courses
- Assess what you value (competence), not what is easily measured (content)
And from a departmental point of view...

Informal motto of the Puckered Penguins:

“One year of experience 24 years in a row….”

Don’t be a Puckered Penguin....
Course design resources

Online, self-paced course design tutorial

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

Course design workshops

Barb Tewksbury: btewksbu@hamilton.edu