Approaching Curricular Re-Design: How and Why?

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First: Why?

- **External Forcing**: states, regional accreditors, and Federal agencies are more and more demanding evidence for effectiveness and cost-effectiveness, and putting $$ teeth in their demands.
  
  - FL examples:
    - **SUS Performance Metrics**, which determine the distribution of $10-100M of state funding each year, depend on improvements in measures related to “student success” (graduation, job placement, cost per degree, etc.)
    - **SACS regional accreditor requirement**: annual collection and analysis of data for student learning in degree programs, with defined plans for annual improvement
      - Newly added: “third party measures” of student learning (validated testing instruments (!!))
  
  - Other examples?

[To document success, you need to know how your courses/programs are working...]

More Why...

• Supporting your students, and your local/regional/national employer communities
  – Are your Bachelors graduates moving easily into the workforce and/or onto graduate degrees?
  • FL example (again):
    – USF Alumni/employer network provides real-time feedback on the suitability of our BS graduates for the environmental industry in the SE US
      » See https://www.youtube.com/watch?v=6FYebZpRQf8 (webinar recording) and/or http://nagt.org/nagt/profdev/serving/posts/177387.html (blog post)
• Do you have linkages or make connections to your local/regional employers re: the readiness of your graduates?
• Do your good students get into MS/Ph.D. programs, as appropriate?
How...

Resources:

- Mogk, 2013: “Curriculum by Design”
  
  - [https://serc.carleton.edu/earthandmind/posts/curriculum_desi.html](https://serc.carleton.edu/earthandmind/posts/curriculum_desi.html)

- “Backward Design”: Identify the learning outcomes you seek (what should students know/be able to do when they’re done), and then build your program to provide instruction/practice to ensure students attain them.
  
  - Evaluation measures track progress and document success (to students and faculty)
  
  - (This approach scales to course development, activity/exercise development, etc.)
Learning Outcomes?

Summit Findings:

- [https://www.youtube.com/watch?v=RosA1hODdQov](https://www.youtube.com/watch?v=RosA1hODdQov) (AGI Webinar)

Consensus view of ≈1000 geoscience educators, employers, and dept. leaders on what a B.S geoscientist should know/be able to do!

- A good starting place for faculty discussions
- **Not one-size-fits-all** (and not intended to be!)
Best Pedagogical Practices:

• **Evidence-based teaching practices:** there are many...
  – *What they have in common* (see McConnell, 2014: [http://www.jsg.utexas.edu/events/files/McConnell-David.pdf](http://www.jsg.utexas.edu/events/files/McConnell-David.pdf))
  • **Interactivity** (student response systems, “just-in-time” strategies)
  • **Collaboration/cooperation** (think-pair-share, jigsaws)
  • **Inquiry** (PBL, Case studies, studio classrooms, CUREs, undergraduate research)
    – **MINIMIZING** straight lecture for content coverage!
    – Frequent, **low-stakes** assessments (tests)

– **Where to find more information:**
  • **SERC** (Teach the Earth: [https://serc.carleton.edu/teachearth/index.html](https://serc.carleton.edu/teachearth/index.html))
  • **National Association of Geoscience Teachers:** [https://nagt.org/nagt/teaching_resources/index.html](https://nagt.org/nagt/teaching_resources/index.html) (Teaching resources)
Transitioning to Evidence-based pedagogies involves risk....

- This process has to be iterative
  - Successful strategies need to be adapted to your institution/classrooms: they won’t work perfectly the first time!
  - Students may (will) protest, initially, even if faculty are clear on the how and why of their new pedagogies

- Faculty will require encouragement, support, and protection to make major changes in their courses
  - Annual reviews
    - Raises tied to annual review/teaching averages (a USF issue...)
  - Tenure/promotion concerns
    - Junior faculty should be encouraged to build in such strategies in their courses at the outset
    - The Early Career Geoscience Faculty workshop offers good guidances here: https://serc.carleton.edu/NAGTWorkshops/earlycareer2017/index.html (just ended!)

- Professional development for helping your faculty transform their courses:
  - Earth Educators Rendezvous (check the program...)

How to start to revise/revision...

• You MUST have faculty buy-in to initiate the process and move it forward!
• Strategies:
  – Faculty retreat devoted to the topic
  – Special committee (with a charge and calendar for deliverables)
  – Find your heroes!!
  – Time at MULTIPLE faculty meetings to discuss issues/progress.
• (for me, at USF, this meant...)
  – Not “protecting” faculty from the external/internal pressures— they saw what was coming and grasped the need and urgency!
  – Major topic at a faculty retreat (kickoff)
  – Primary charge for our Undergraduate Committee
    • Adapted the Mogk (2013) matrix to our program to define outcomes and “fit” to our existing program
    – Repeat topic at faculty meetings (ongoing....)
• Strategies from others?
Big Challenge: Knowing (and showing) it works!

• **Evaluation**: Does the program succeed in attaining its targeted outcomes?
  – Should include “throughput” measures (no. graduates, avg. GPA employment success, grad school admits, etc.) as well as learning assessment data for students.

• **Assessment**: Do students gain the targeted competencies and skills by the end of the program?
  – Student learning assessment data ≠ GPA!

• **Assessment data needs to be collected at the course level to attain program-scale results**
  – Measurement at several stages (freshman/sophomore, Junior, Senior-level courses)
Learning Assessment “instruments” for concepts/knowledge

- **Surveys**
  - **SALG - Student Assessment of Their Learning Gains** ([http://www.salgsite.org/](http://www.salgsite.org/)): a customizable instrument that allows faculty to tailor questions to their courses.
    - Includes both conceptual and attitudinal (affective) measures
    - Can be designed (by instructors) for any course
    - Limitations: student self-reporting, participation

- **Concept inventories**
  - Validated measures (questions) targeting **conceptual understanding**
  - Mostly for introductory courses, but expanding....
    - Geoscience Concept inventory (GCI) ([https://geoscienceconceptinventory.wikispaces.com/](https://geoscienceconceptinventory.wikispaces.com/))
    - Conceptest collection (SERC): originally designed for “clicker” use, but has broadened out ([https://serc.carleton.edu/introgeo/interactive/conctest.html](https://serc.carleton.edu/introgeo/interactive/conctest.html))
    - Oceanography Concept Inventory (Arthurs, Hsia, Schweinle, 2015, J. Geosci. Ed., 63: 310-322)

- **“3rd Party Instruments”:**
    - Departments get anonymized results,
    - NOT FREE...
Assessment of Skills Development?

- **Capstone/integrative experiences**
  - Geology Field Camps
    - Mapping and other field data collection/interpretation (geophysics, hydrology, etc.)
    - If your Dept. doesn’t teach field camp, other courses/assignments may be appropriate (at USF we do both...)
      - rubric based, multiple raters...
  
- **Undergraduate Research**
  - High Impact Pedagogy *(PCAST 2012; Lopatto 2007; 2010)*
  - Develops key scientific skills + technical + “soft” skills
    - Senior Theses (some do this as a capstone...)
    - Course-based undergraduate Research Experiences (CURES) – advocated by PCAST and by the National Academies *(NRC 2015; 2017)*
      - Research products (papers, presentations) can provide evidence of accomplishment/success in a course or a program, as can perspectives from students and their mentors
      - See Singer and Mogk for strategies/background:
        https://serc.carleton.edu/NAGTWorkshops/undergraduate_research/assessment_pedagogy.html

(None of these are very easy to do, but they’re important...)
Assessment/Evaluation/Curriculum change doesn’t happen…

…Unless a Department is willing to do it!

• Chair leadership is critical!
  – “sticks”
    • An annual requirement, an evaluated activity
      – (everybody plays: participation can’t be optional…).
      – Data collection, and data review/analysis has to occur routinely.
        » At USF: our undergraduate committee compiles annual data for faculty review/discussion.
  – “carrots”
    • Re-assign time for curricular work
    • Professional development for course transformation ($$)
    • Granting opportunities (IUSE-EHR, the ICT track…)