**History & Inception:** Fertile Ground & Catalyst

**What prior conditions enabled development of a GER capacity?**

**What events sparked the start of GER at UBC?**

**Fertile ground for inception of GER includes:**

- **The Institution (UBC):**
  - Learning, a pillar in UBC's T2020 Vision (1).
  - TAG – UBC’s teaching and learning resource (2).
  - Faculty Certificate Program on Higher Ed Teaching & Learning (3).
  - SkyLight: a research-focused unit at the Faculty of Science (4).
  - Proactive & visible support of student learning – eg LEAP at (5).

- **The Department: Earth and Ocean Sciences (EOS):**
  - 10-year Academic Plan (6); and 2005 external Dep’t review (7).
  - 10% of tenured faculty have a teaching-focused mandate.
  - Innovations: Contributions to Science-1 (8), Integrated Sciences (9), Environmental Sciences (10); use of TBL, clickers etc.
  - Internal culture has been consistent with curriculum reform (11).
  - Egs: Attention to student skill & values development; learning-centered curricula; constructivist pedagogies.

**Catalysts that kick-started GER were...**

**Sense of urgency (12):** history (above) & institutional challenge to reform undergraduate education (CWSEI).

**CWSEI:** See (13) “A new model for post-secondary education, the Optimized University”, C. Wieman.

“A five-year, $12M project at UBC to dramatically improve undergraduate science education” (14)

Goal: “achieve highly effective, evidence-based science education for all students by applying the latest advances in pedagogical and organizational excellence.”

1. What should students learn (needs & goals)?
2. What are students actually learning (assess, measure, evaluate)
3. Improve student learning (active learning, feedback, learning skills, metacognition, solo / group, etc...)
4. Also: account for practicalities and “how instructors change”.
5. Finally: provide expertise on how people learn and science education.

**The model for change at EOS:**

- Department-wide approval of a project proposal (17) which defines how the Department will implement the above 3 CWSEI goals.
- Hire 4 full time Science Teaching & Learning Fellows (STLFs).
- Collaborate & learn with colleagues across disciplines.
- Support from Sci / Ed expertise of C. Wieman and S. Gilbert.

STLFs as “Agents of Change”: their mandate is to support institutional change towards evidence-based practice in undergraduate science education.

**Development & Sustainability:** Growth & Maturity

**What components that fostered growth, and indicate maturity, of our Geoscience Education Research capability?**

**Growth: keys to progress towards critical mass for GER at UBC:**

**CWSEI fundamental practices (14):**

- Use, Generate, Disseminate research on learning, & avoid re-invention.
- Sustainability: Changes to best practices must persist into the future.
- Time / resources for scholarly practice.
- Community development: Consulting for research faculty, use SciEd literature, bring in expert visitors, run events, produce publications and presentations, collaboration with STLFs and other colleagues, etc...

**STLF model for education research & reform (15) and (16):**

- **STLF’s background:** Geosci. PhD or MSc with Sci. Ed. interests
  - Typical duties are to...
    - Facilitate communication and consensus building
    - Collaborate with faculty to develop materials and teaching approaches
    - Serve as a local resource for faculty
    - Collect / distill / communicate data to support and guide faculty efforts
    - Ensure sustainability by archiving and disseminating
  - Barriers & Facilitating factors are in (15) & (16)

**Our maturing GER program includes...**

**CWSEI influences:**

- Broad dissemination of outcomes, including public & private archiving of materials, strategies, practices, challenges (17)
- Resources website (eg summaries of key articles, etc.) (18)

**Sustaining GER:**

- Institutional support for SoTL activities (see “Fertile ground” above.)
- Department-level leadership
  - Especially by teaching-focused faculty.
  - Strong support by the Dep’t Head
  - New teaching assistant training course (29)
- Publications – Since 2007 in our Dep’t...
  - >10 Conference contributions & workshops
  - 2 U.Grad theses on GER,
  - 5 Articles in preparation.

**Geoscience community support**

- This session 1 And others, (GSA 2009 → 27 sessions on Geosci. Educ.)
- Visibility: disseminate GER in specialist journals. Eg EOS.
- Workshops, eg The Cutting Edge (19)
- Outreach components on grants
- Incorporate evidence-based practices in all your teaching.
  ( i.e. treat teaching as you would your research ! )

**Programmatic & Research Results**

**What evidence is there that science education reform and geoscience education research is emerging at UBC?**

**Science Education Improvement Program results so far:**

- **Science education reform:**
  - Results
    - To date, 70% of faculty involved; 20 courses transformed or in progress (20)
    - Curriculum: research (21) & initial recommendations approved Apr’09.
    - Both Graduate and Undergraduate students are participating.
    - Student attitudes about the geosciences – SASS project (23)

**Geoscience education research:**

- Indicators of growth (Details in (24))
  - Undergraduate theses (below)
  - Faculty self-propelled education innovations (although no “research” as yet)
  - Longitudinal commitments - eg Exit Survey of graduating students.
  - Graduate students (future academics I ) are participating in, and initiating, GER

**Example of how research emerges:**

An honors thesis evolved from one summer student’s work with (i) a previous undergraduate GER honors thesis (28), (ii) attitudes survey results (23), (iii) our course transformation results (20).

**Pre-post Testing: what works and what doesn’t work**

- Question: How best to design and utilize before- and after-course testing?
- Method: Several pre-post tests were implemented in a first year lab course.
- Results: Positive and negative results help build tests that are useful to both students and instructors.

**A Quantitative Classroom Observation Protocol (25)**

- Question: How does instruction change student engagement?
- Method: A reliable, reproducible, protocol for observing students during various types of classes.
- Results: Instructors modify content, pacing, active learning to keep engagement high. Paper in progress.

**Undergraduate thesis topics**

2009: "Understanding Geological Time: A Proposed Assessment Mechanism for Beginner and Advanced Geology Students at UBC" (28)

2010: "Timescales of Landscape Formation: Student Knowledge & Confidence" in progress.

**References (1) through (29) are attached.**

Please email <fjones@eos.ubc.ca> for a copy of the poster with the complete list of pointers and citations.

We thank the staff at CWSEI and the faculty, graduate students and undergraduates in UBC’s Department of Earth and Ocean Sciences who have embraced the project aims with energy and enthusiasm.