Adapting F2F Best Practices for Large, Online Geoscience Courses: Design, Implementation and Evaluation of Effectiveness

GSA 2017: Session T 128

Francis Jones*, Louise Longridge, Stuart Sutherland and Sara Harris

Can the best of f2f be adapted for DE?

A hypothesis:
(Helps ground our work in evidence-oriented practice)

Real or virtual labs can foster similarly effective and efficient learning experiences & outcomes in either f2f or DE settings.
Presentation Focus

Education development – especially DE – consists of 3 components
1. The learning tasks; what students do, learning strategies, pedagogy
2. Learning resources (the “tech”)
3. Project evaluation – are initiatives “succeeding” (whatever that means)

Here we focus on
• Item (1): Comparing learning tasks for two settings; f2f and DE.
• Item (3): Assessing initiative effectiveness (via the hypothesis).

Today ...

• A framework to help ground development in precedent.
• Compare face-to-face (F2F) & distance ed’n. (DE) settings for one lab exercise.
• Outline interactive resources, activity sequencing and group dynamics.
• Test hypothesis:
  – Lab and resources
  – Instructor and student Efficiency
  – Effectiveness (learning outcomes / deliverables)
  – Student experiences
• Ongoing refinements and conclusions
A framework for research/development: **Learner interactions**

**Balance and variety of interactive learning pathways**

- Student $\leftrightarrow$ content
- Student $\leftrightarrow$ colleague
- Student $\leftrightarrow$ expert (instructor / TA)

- Interactions should foster or enhance
  - motivation,
  - deliberate practice,
  - peer-assisted learning and
  - timely feedback on student thinking, enabling a safe place to "fail" before succeeding.

---

**Face-to-face learning interactions:**

- Handle, discuss, examine specimens (eg hand lens)
- Think, try, adjust - peer interactions, sketching, analyze, discuss with experts

---

1E.G. Kennepohl and Shaw. 2010
### Part I components for both versions of this exercise:

**Week 1, F2F lab:**
- 2. Paper worksheet for 21 fossils: IDs & ages
- 3. Hand samples & photos of specimens - 1 hr in lab with specimens & instructors
- 4. Online q’ns about fossils - all multiple choice.
- 5. Sketching /annotating for some portions. - All graded by TAs

**Phase 1, DE "lab":**
- 2. Paper worksheet with scenario, 17 fossil: IDs & ages - THEN, digital input & autograding of IDs / ages
- 3. Interactive "lab environment" with digitized specimens - Images: high res., zooming, multi-view, videos: of “handling”
- 4. Online q’ns about fossils to address the scenario. - multiple choice + ranking, matching, fill-blank, etc.
- 5. Digitally sketch to annotate given base-line figures. - Sketch submission only graded by TAs.

*Red underlined = innovation for DE*

### Part II components for both versions of this exercise:

**Week 2, F2F lab:**
- 1. Ad-hoc groups of 4-6 in class: Agree on and re-submit fossil ID and ages.
- 2. Groups: answer 2 point-form written questions.
- 3. Groups: sketch a collective “re-interpretation”.
- 4. Grading and feedback: - all work graded by TAs. - PDF solutions provided online.

**Phase 2, DE “lab”:**
- 1. Permanent teams of 6-8 Agree on & re-submit fossil ID and ages.
- 2. Agree on & re-submit two point-form written questions.
- 3. Agree on & re-submit sketched “re-interpretation”.
- 4. Grading and feedback - Sketch only, graded by TAs (250 takes ~8hrs total) - Feedback from TAs, and built into auto-grading.
Interactive resources

Interactive lab-space & specimens:

• ALSO - Variety of auto-grading question types + some open “attitude” or “opinion” questions.

Sequencing is one key difference

Face to face:
→ 1 hr lab with peers & instructors
  → homework and online qns (1 week)
    → 1hr group activity in class to follow up on interpretations & questions

Distance Education:
→ Online worksheet with interactive resources (1 week)
  → submit worksheet results online for auto-grading
    (students each get a random subset of questions).
  → online discussion broad: teams address interpretations & application
Group dynamics is another key difference ...

**Face to face:**
→ Groups are “live”, real time person-person interactions.

**Distance Education:**
→ Groups are asynchronous – post → read → react → read etc...

Many technical options do exist – but in our case, DE students are global and discussion boards are already used during the course.

---

**Testing the hypothesis**

“*Real or virtual labs can foster similarly effective and efficient learning experiences & outcomes in either f2f or DE settings.*”

**Key testable words in this statement:**
1. Laboratory
2. Similar learning experiences
3. “Efficient” = Instructors & students time
4. “Effective” = Similar learning outcomes / deliverables
5. “Experiences” includes student perceptions.
Indicators re. “efficient” for instructors

“Costs” and commitments:
- Instructor participated throughout
- Time during development was funded (internal grant)
- Time to deliver after: “no complaints”.
- Instructor “enthusiastic” during development
- Instructor persists in using 3yrs after development.
- TA time NOT increased.

Indicators re. “efficient” for students

- More time on task
- More student D-B posts (from LMS analytics)

From:
“Effective” – compare deliverables in both settings

- Consistent pre-post paired scores.
- Group-work does support improvement of conceptual understanding.

Egs.
Student sketch work→
(Use fossil data to mark stratigraphic horizons across 3 sections. Results solve a synthetic dating problem.)

- More examples at:

“Experiences” – perceptions (2 of several survey questions)

“Were discussion boards helpful”? (2 of several survey questions)

◆ q15: Answers to questions via discussion board were ...

■ q12: Discussion board interactions with other students were ...

Based on “helpfulness” questions of Jones, 2017.

---

Conclusion – Adapting F2F Best Practices for DE

Context
- Hypothesis helps focus such research / development
- Framework helps base tactics & priorities on precedent
- Laboratory learning goals and learning outcomes/deliverables are the same.

Deployment
- Details differ, but not students’ learning tasks:
  - **F2f**: a facilitated lab for 50 students with in-class, group-based followup activity (150+ students)
  - **DE**: sequenced tasks, discussion boards, student perceptions via embedded survey questions
- Instructional costs (i.e. time) similar in f2f and DE
- Student outcomes / deliverables similar in f2f and DE
- Inexpensive, unobtrusive analytics contribute to project evaluation
- This pilot study feeds forward into current and future developments.

Extra: interactive resources we are using

See [http://blogs.ubc.ca/eoassei/resources-tools/](http://blogs.ubc.ca/eoassei/resources-tools/)
- **Interactive lab space** – interactive high-res via zoomify
- **Hi-res specimens** (as per gigapan, but with free or almost free tools, like ICE and zoomify), including focus-stacked examples.
- **Sketching** – literally canvas
- **Interactive reading** sequences (via free tools = hotpotatoes)
- **Imagemaps**
- **Museum** (PME) Google street view
- **VisibleGeology.com**
- **Online databases**: Burgess Shale, Near Earth Objects, Earth Impacts, etc.
- Google maps and fusion tables (eg soilx.ca)
Resources for this talk

- Blog:  http://blogs.ubc.ca/eoassei/
- Hazards: https://blogs.ubc.ca/eoashazards/