Dep't Earth, Ocean & Atmospheric Sciences

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Adapting F2F Best Practices for Large, Online Geoscience Courses:
Design, Implementation and Evaluation of Effectiveness
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GSA 2017: Session T 128

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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[1]

- Student ←→ content
- Student ←→ colleague
- Student ←→ 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.

[1]E.G. Kennepohl and Shaw. 2010

Face-to-face learning interactions:

Handle, discuss, examine specimens (eg hand lens)

Think, try, adjust - peer interactions, sketching, analyze, discuss with experts

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Part I components for both versions of this exercise:

Red underlined = innovation for DE

Week 1, F2F lab:	Phase 1, DE "lab":
2. Paper worksheet for 21 fossils: IDs & ages	2. Paper worksheet with scenario, 17 fossil: IDs & ages - THEN, digital input & autograding of IDs / ages
3. Hand samples & photos of specimens - 1 hr in lab with specimens & instructors	3. - Interactive "lab environment" with digitized specimens - Images: high res., zooming, multi-view, videos: of "handling"
4. Online q'ns about fossils - all multiple choice.	4. Online q'ns about fossils to address the scenario. - multiple choice + ranking, matching, fill-blank, etc.
5. Sketching /annotating for some portions. - All graded by TAs	5. Digitally sketch to annotate given base-line figures. - Sketch submission only graded by TAs.

Part II components for both versions of this exercise:

Week 2, F2F lab:	Phase 2, DE "lab":
1. Ad-hoc groups of 4-6 in class: Agree on and re-submit fossil ID and ages.	1. Permanent teams of 6-8 Agree on & re-submit fossil ID and ages.
2. Groups: answer 2 point-form written questions.	2. Agree on & re-submit two point-form written questions.
3. Groups: sketch a collective "re-interpretation".	3. Agree on & re-submit sketched "re-interpretation".
4. Grading and feedback: - all work graded by TAs. - PDF solutions provided online.	4. Grading and feedback - Sketch only, graded by TAs (250 takes ~8hrs total) - Feedback from TAs, and built into auto-grading.

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Interactive resources

Interactive lab-space & specimens:
demo
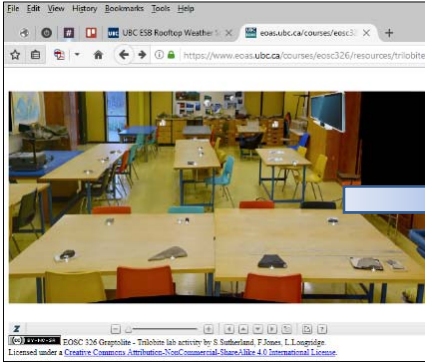
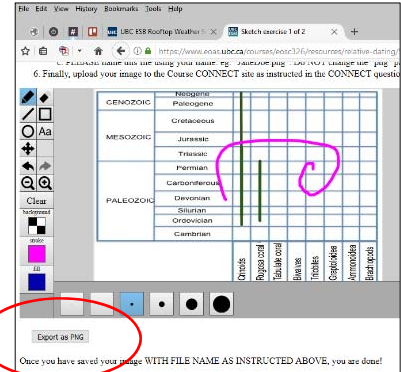*Video*

Hi-res zooming gigapixel images

Details

More details

Sketch app: *demo*

- **ALSO** - <u>Variety</u> of auto-grading question types + some open "attitude" or "opinion" questions.

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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.

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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.

- **Increased cognitive level of tasks**
  Eg: "*Use data & knowledge to decide if dinosaurs recently found in coastal BC / Washington were likely related to Asian or Albertan populations.*"

## 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

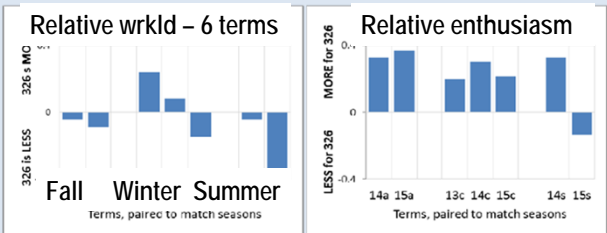– Instructor persists in using 3yrs after development.

– TA time NOT increased.

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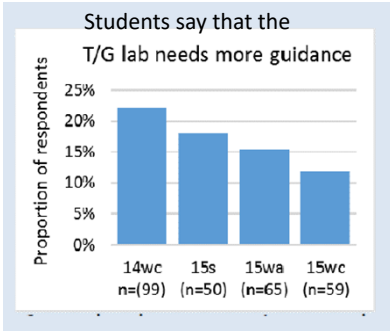
Indicators re. "efficient" for **students**

• More time on task

• More student D-B posts

(from LMS analytics)
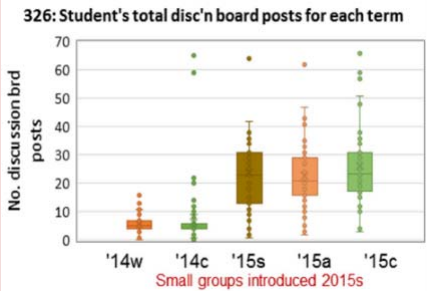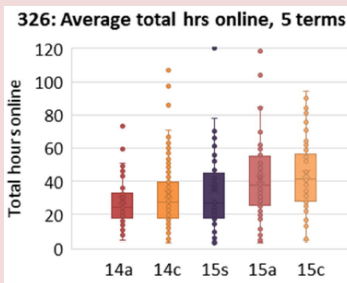
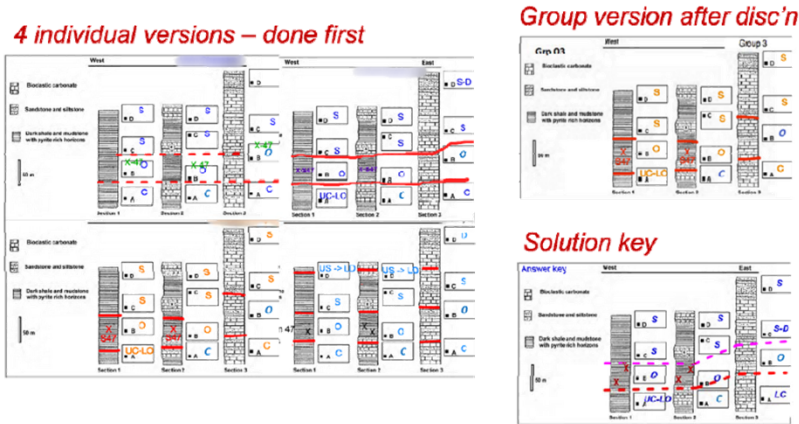

• Workloads deemed to be "less".

• Enthusiasm remains "high.

From:

Jones, Francis. 2017. "Comparing Student, Instructor, Classroom and Institutional Data to Evaluate a Seven-Year Department-Wide Science Education Initiative." *Assessment & Evaluation in Higher Education*, June, 1–16. doi:10.1080/02602938.2017.1343799.

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"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 strat-
igraphic horizons across 3
sections. Results solve a synthetic
dating problem.)*

- More examples at:
  http://cwsei.ubc.ca/Files/EOY/EOY2016/Posters/Jones-etal_Distance-Ed_UBC-SciEd-OH2016.pdf

"Experiences" – perceptions (2 of several survey questions)
"Were discussion boards helpful"?

◆ q15: Answers to questions via discussion board were …

■ q12: Discussion board interactions with other students were …
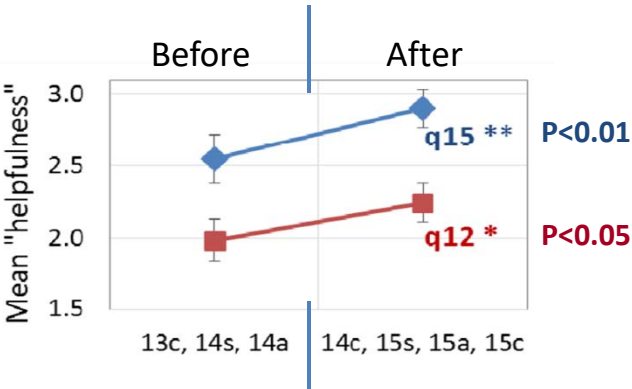
Based on "helpfulness" questions of Jones, 2017[1].

[1] Jones, Francis. 2017. "Impact Assessment of a Department-Wide Science Education Initiative Using Students' Perceptions of Teaching and Learning Experiences." *Assessment & Evaluation in Higher Education* 42 (5): 772–87. doi:10.1080/02602938.2016.1188057.　　11

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.

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Extra: interactive resources we are using

See 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/
- Video: http://blogs.ubc.ca/wpvc/watch-look-for-the-laboratory-experience/
- Hazards: https://blogs.ubc.ca/eoashazards/