Can students taking DE or f2f versions of the same course have equally effective / enjoyable learning experiences?

UBC FoS Supper Series, Nov 17, 2015

Francis Jones, with Louise Longridge
First, frameworks...

Traditional...
• Content
• Instruction
• Practice
• Assessment

RBIS...
• Motivation
• Practice that is \textit{deliberate}
• Solo and "social" learning
• Timely \textit{interactive} feedback

Teaching = enabling RBIS by \textit{facilitating} interactions:
• Student $\leftrightarrow$ Content
• Student $\leftrightarrow$ Student
• Student $\leftrightarrow$ Expert
  (Instructor / TA)

Compare: opportunities / challenges

EOAS flexible learning project and courses
• Courses
• Specific DE to f2f translation project component
EOAS Flexible Learning project, 2014-16

**Enrollments**

<table>
<thead>
<tr>
<th>Course</th>
<th>Sections</th>
<th>1st Year</th>
<th>3rd Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOSC 326, Earth and Life Through Time</td>
<td>~450</td>
<td>1 f2f</td>
<td>3 DE</td>
</tr>
<tr>
<td>EOSC 116, The Mesozoic Earth</td>
<td>~350</td>
<td>1 f2f</td>
<td>3 DE</td>
</tr>
<tr>
<td>EOSC 118, Earth’s Treasures: Gold &amp; Gems</td>
<td>~600</td>
<td>3 DE</td>
<td></td>
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</tbody>
</table>

All service courses, not core.

**Introduced since 2014**

**Student ↔ Content**

1. **“Interactive” readings**: instant feedback on questions.
   - Tasks and questions embedded in basic content.
   - Instant feedback; not necessarily ‘graded’ ... but “instant”.

2. **Interactive figures** using image maps and JavaScript.

3. **Labs**: generate & share sketches and annotated figures.

4. **Several low-stakes, post-activity “quizzing” opportunities**
   - MC, ranking, fill-blank, matching, jumbled sentence, numerical, etc.
   - “Blooms Dichotomous Key”; check q’n sophistication & set targets.
   - Higher stakes testing familiar tasks and question types.

*Eg. Clark and Mayer, 2011

**Stuff students did in 326-DE**

**Originally (~ 2005)**

- Readings → module tests; largely multiple choice (MC).

- 2 “labs”
  - review content and resources,
  - answer MC questions.

- 2 Discussion board tasks:
  - intro;
  - short essay + 1 response.

- Discussion board open forums for questions.

**Introduced since 2014**

**Student ↔ Student**

1. **Cooperative versus Collaborative**:
   - distribute work & ‘agree’ versus generate a whole bigger than the parts

2. **Cooperative opportunities**
   - Semi-structured discussion (“introduce yourselves and chat”)
   - Share results of solo work in groups
   - Generate group versions of: quizzes (eg. 2-stage tests) or Cooperative products (eg. sketched problem solutions)

3. **Collaborative opportunities**
   - Construction of knowledge and/or products (eg museum displays)
   - More autonomous than prescribed cooperative exercises
   - Blogs, journals, wikis, Google Docs, Google Earth

*Cooperative vs collaborative: see eg. Panitz, 1999
**Introduced since 2014**

**Student ↔ Instructor**

Expert ↔ novice interaction is important and “precious”

1. **Design** / facilitate semi-structured discussions.
2. **Rubrics** and exemplars
3. **Feedback on intermediate** work (may be automated)
4. **Feedback on final** work;
   - Collected feedback about all student work;
   - Personalized by referring to collected items.
5. Implement – and act upon – **student feedback**

**Outline ....**

1. First, a framework.
2. Compare challenges & opportunities in DE vs f2f.
3. Project context
4. Specific initiatives
5. One f2f → DE conversion example.
   - Project process
6. Evidence of change:
   1. Student products
   2. Quantitative / Qualitative feedback
   3. DE tool usage: groups, forums, online “hit-rates”, workloads, etc.
7. Discussion

**Before progressing ... the ‘skinny’**

1. These supper-series events always evolve (devolve?) into great discussions, so ...
2. Partial “conclusions” so far - since project evaluation steps are in progress.

**Can students taking DE or f2f versions of the same course have equally effective / enjoyable learning experiences?**

*Yes, but with different types of instructional effort.*

**We are encouraged by ...**

1. Interactive resources can be constructed WITHOUT particularly special skills.
2. Engaging tasks can be developed with care and attention to purpose and pedagogic detail.
3. Asynchronous small group interactions work with careful scaffolding.

**We still need to do better at**

1. Closing the feedback loop VISIBLY and productively
2. Assessments: a) align with tasks/activities & b) increase variety
3. Shift learning goals off “knowledge” towards “skills”.
4. Incorporating analytics: Assessments & resource use or online behaviour.
Project progress so far ...

**Successes**
- Engaging, effective learning tasks and resources can be facilitated
  - We are still refining details.
  - Some simple 3rd party facilities are needed.
- Learning goals tend to evolve “organically”.

**Project Evaluation**
- Analytics data are hard to get, often requiring processing of raw data.
- Tests evolve with innovations, hence comparing before-after change is hard.
- Assessment sophistication can be gauged with Blooms Dichotomous Key.

Implications

**For instructors**
- DE pedagogy is different. Experience with f2f is not enough. Example: experience is needed developing questions in M.C. and other formats.
- Experience with Connect is vital – or close knowledgeable support.
- Awareness and moderate skill with web technology and resources is vital for development, less so (but still important) for instructors themselves.

**For departments**
- Need “official” points of contact for DE-instructional support.
- Need facilities to host resources that are not Connect-compliant.
- Converting course components DE ↔ f2f is possible but non-trivial.
- Can NOT improve a course with same resources used to “just” teach it.

**For institution**
- Analytics is necessary BOTH for improvement AND evaluation.
- Analytics for instruction has potential but needs development.
- I.T. support OUTSIDE the LMS is necessary, perhaps at Dep’t level.

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Example f2f activity / Lab:

See video examples showing lab and classrooms in action

• One 50 minute lab examining fossil and rock samples with TAs and instructor present.

• One 50-minute structured group activity follow up a week later.

• Some online quiz-like homework.

For DE – can we develop ...

• Same learning goals?
• Similar experiences?
• Online data entry (after paper work)?
• Online sketching and upload of results?
• Online digitized resources emulating specimens?

Hands-on f2f components

Lab time
Handle specimens
Follow-up group-work in class with paper worksheets

Virtual components for DE

[http://eos.ubc.ca/courses/eosc326/content/trilobite-lab/](http://eos.ubc.ca/courses/eosc326/content/trilobite-lab/) ID, PW in notes.

Zoom-in high resolution lab space with clickable Hotspots.
Hi-res specimen images + videos of “handling”
Components for BOTH f2f and DE

Same specimens

Same tasks
(including sketching)

Same goals.
Same documents.

DE and f2f differences:

Week 1, F2F lab:
1. Manual / instructions
2. On paper: 21 fossil IDs and ages
3. Hands on:
   - real specimens
   - photos
   - 1 hr in lab with instructor & TAs
4. Online questions about fossils
   - all multiple choice.
5. Sketching on paper.
   - Graded by TAs

Phase 1, DE “lab”:
1. Same .... add a scenario
2. 17 of 21 fossils, 3 exemplars
   - Digital input & autograding of IDs / ages
3. Digitized specimens
   - Interactive lab environment
   - Images: high reso’l’n, zooming, multi-view
   - Videos: of handling specimens
4. Online q’ns (not all MC) about fossils to address aspects of the scenario.
5. Digital sketch: annotate given figures.
   - Sketch submission only graded by TAs.

DE and f2f differences:

Week 2, F2F lab:
1. Groups: Agree upon / re-submit fossil ID and ages.
2. Groups: answers to 2 point-form written questions.
3. Groups: Agree upon and re-submit sketched interpretation.
4. Graded by TAs.
5. Solution set: PDF provided online.

Phase 2, DE “lab” – Add team work:
1. Not done.
2. Questions done solo only.
3. Small groups: share, then agree upon and re-submit sketched interpretation.
4. Sketches graded by TAs
5. Solutions after grading.

NOTES:
- Groups are permanent.
- This is the 3rd of 4 small group tasks.

Questions? Comments?

• Framework
  - Facilitate RBIS by addressing interactions.
  - S <-> C S <-> S S <-> E

• Project context
  - Initially: 2 service courses, 1 DE instructor, 1 f2f instructor.
  - Subsequently: 3rd DE service + 2nd DE instructor, and others.

• Specific activity conversion
  - A hands-on / classroom exercise for asynchronous DE.
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Evidence of change ...

- We are 19 mths into 24mth project; Collecting / assessing data is ongoing.
- DE courses produce a richer data-trail than f2f.
  - BUT ... accessing data is challenging (i.e. Connect is not helpful)

Evidence of ...

- Student interactions.
  - Content, Colleagues, Instructor / TAs
- Online and group-work behaviors.
- Decisions, interpretations and “products” that students produce.
- Requested feedback.

Evaluation options – i.e. possible comparisons:

- Compare DE and f2f activity, engagement & outcomes
- Compare prior- to current- interactions
- Compare prior- to current- outcomes

Actions versus evaluation:
An evolving project process ...

- Evaluation details evolve based on success (or not!)
- Ideally, learning goals are the primary driving force
  - BUT the process is not linear and takes iteration
  - Why? Because it is not initially obvious which new ideas will be practical and what won’t.
  - Requires an instructor who can confidently handle glitches.

Data sets

- Tests, quizzes and checkup on activities.
  - Analytics workflows are under development.
- Feedback results
  - Added as a small part of activities or tests.
  - Active readings feedback
  - Whole course workloads and enthusiasm
- Hits or time in segments of CONNECT
  - Course activity / Forums / Groups / single student
  - “Reports” and download formats are awkward
- Group work results
  - Activity reports and thread listings (some manual analysis is possible)
- Image work results
  - Annotated figures on uniform base-images

Data contexts

- Quizzes, midterms, exams
- Lab exercises
  - Our focus today
  - Includes sketching results
- Small group activities
  - Introduction
  - Lab 1
  - Lab 2 (feedback)
  - Short essay and response
- Online "activity"
  - Content
  - Hours
  - Hits on the course site

Questions? Suggestions? Or discuss & wrap-up
Exam / test results.

Not really ready yet; Why?
- Exams evolve with changes to learning goals and activities.
- Labour intensive since Connect is “stupid” about analytics.
- But – we can analyze for test sophistication. Eg: Compare earlier f2f and DE exams; “Blooms Dichotomous Key”

Solo and group results
- Solo tasks:
  - Interpret 16 fossils from 4 “depths” at 3 locations, + 1 other unknown.
  - Determine ages from references.
  - Sketch lines bounding ages on geologic sections.
- Groups task:
  - Agree on age boundaries.

Data about the lab exercise
- Compare DE to original f2f exercise
- Sketches (solo and group)
- Discussion activity in groups
- Feedback about resources and workloads

Note: More here than we can cover, but we can pick and choose 😊
Lab 2 sketch result: eg. from one group
- Solo work varies in correctness and completeness
- Group work iterates towards correct & complete interpretation

4 individual versions – done first
Group version after disc’n
Solution key

Lab 2 sketching: solo and grp error rates
- Based on rubric components.
- Groups “better” than solo, but ... could scaffolding be improved?

Lab 2 sketching: solo and discussion results
- Who posts ... How often?
- 12 groups
- Wide range of active-ness
- 2nd to post seems most active
- Very slight relation between score and group post-counts.
- Evidently, some room to improve scaffolding and motivation.

Lab 2 feedback
- “More of these would be great” ...
- ‘14-’15 diffs in mean not significant.
Lab 2 feedback

• Which resources were Most / Least useful?
  – Video was “least” by smaller proportion of students in 15s.
  – Otherwise, similar.

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<th>Most</th>
<th>Least</th>
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<td>video</td>
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<td>15s</td>
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<td></td>
<td>2%</td>
<td>15%</td>
</tr>
</tbody>
</table>

• Did you use other sources? Which were most useful?
• More details next slide

Feedback from T/G lab 1st and 2nd iterations

Outside resources used?

2nd iteration after some changes to questions and guidelines.
(Could apply χ²-test, but ’14 and ’15 do seem quite different).

Feedback from T/G lab 1st and 2nd iterations

Did you use other sources? Did you like the sketching app? Dislike it? Any suggestions?

Outside resources used?

2nd iteration after some changes to questions and guidelines.
(Could apply χ²-test, but ’14 and ’15 do seem quite different).

Feedback from T/G lab 1st and 2nd iterations

Any other suggestions

none or positive
instruct’ns, concise, clarity
improve resources
time - too long
provide more practice
sketching app (negative)
have groups
other

2014wc (105)
2015s (55)
Feedback from T/G lab 1st and 2nd iterations

Any suggestions?

• Like it. Lab 2 sketching felt unnecessary but lab 1 sketching was really helpful (especially when we compared with a group).

• I think activities like these are extremely useful and fun when you can actually go into a lab with other students, but I found it difficult to make myself sit down and go through it on the computer; it isn’t as fun or exciting seeing everything behind a screen and a lot of the time the interaction with other students is needed in order to figure things out.

• I liked this portion of the lab and really helped me with my understanding of the geological time columns and also helped me confirm my answers in worksheet 2.

• From First Version: It might be nice to somehow incorporate group work into the activity (since in-class labs often benefit from team work).

Conclusions:

• Compare student feedback 2014 winter and 2015 summer

• 2014w = first attempt and NO group work

• 2015s = second attempt WITH group work

• Fall 2015 runs Nov 13th – 25th.

• Feedback suggests students reacted similarly.

• Conclusion – we need to pay closer attention to collective feedback and address common issues and recommendations.

General small groups data

• Compare prior to current DE course

• Recall – 4 small group activities

  1. Introduction
  2. Lab 1
  3. Lab 2
  4. Short essay and response

Hits within all groups

• Using Connect’s “report” data.
**Hits within groups each day per student**

- Interaction with colleagues is distributed across the term.

**How active are small groups?**

- This is quantity not quality, but group behavior seems to vary.
- Room for improved scaffolding and motivation.

**Total discussion board posts**

- Quantity of interaction with colleagues is increased.
- What about Quality???

**Short essay + discussions: before/after small grps**

**2014wc and before**
- Grps of 40-50 for this assign. only
- Five forums (topics) per group.
- **Short essay:** post under 1 of 5 topics (ie. forums).
- **Respond** to one other.

2 required posts
- ~ 1 “thread” / student
- ~ 3 posts / thread

**2015s and after**
- Same small grps for 4 activities.
- One forum (per grp) for this assig.
- **Short essay:** post as a new thread, any 1 of 5 topics.
- **Reply** to 3 others.
- **Respond to 1 reply** (i.e. “discuss”).
- **Discuss further for bonus pts.**

5 required posts
- ~ 1 “thread” / student
- ~ 7 posts / thread
Activity in forums

Small groups introduced 2015s.
- Reduced unstructured engagement about content
- Increased structured engagement in 4 small-group activities.

Total activity: hours and “hits”

- Are students spending more time?
  - DE may be able to explore this question more easily than f2f.
- Compare prior to current DE course

Total hours online

- Total hours is not significantly (Pr=0.206) different in three terms.
- However box plots and stdev do suggest increased variability.

Summary:

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<thead>
<tr>
<th></th>
<th>2014wa</th>
<th>2014wc</th>
<th>2015sa</th>
</tr>
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<tbody>
<tr>
<td>Activity 1: Fossil Identification and...</td>
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<tr>
<td>Lab 1: Relative Dating Using Rocks...</td>
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<tr>
<td>Lab 2: Trilobites/Graptolites</td>
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<tr>
<td>Activity 2: Coast Fossils</td>
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</table>

Total hits in Connect each day per student

- Total hits did not change after adjusting to 4 small group tasks.
- However, engaging in the course became less sporadic.
One more idea ...

- Correlate “total submissions” versus final grades.
  - $R = 0.46$  \hspace{1em} (or $R^2 = 0.213$)
  - Not particularly convincing.
  - But consistent with other “time-on-task” vs “success” studies.

Workloads, enthusiasm and experiences

- Compare “new” DE to prior DE and f2f.
- Uses results of SLES (Student Learning Experiences Survey)

SLES for DE and f2f

“Significant” differences between f2f and DE

- Student Learning Experiences Survey (SLES);
  - 45 Likert-scale questions in f2f courses
  - 55 Likert-scale questions in DE courses
- For how many strategies do mean responses vary significantly?

<table>
<thead>
<tr>
<th></th>
<th>$P_{adj} &lt; 0.05$</th>
<th>$P_{adj} &lt; 0.01$</th>
<th>N</th>
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</thead>
<tbody>
<tr>
<td>Between 4 DE sections</td>
<td>5</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>Between 4 DE and 1 f2f</td>
<td>5</td>
<td>12</td>
<td>22</td>
</tr>
</tbody>
</table>

- No open questions analyzed yet.
SLES for DE (and f2f)

No specific “group” questions, BUT – 2015 is 1st to use small groups

• Other homework exercises (Not quizzes; eg. problem sets, etc.)
  \[ P = 0.0241 \]

• Projects you did with other students (written, oral, poster, etc.)
  \[ P = 0.0002 \]

Activated readings feedback

• Early “active content”. Questions asked to recommend changes.
• Resulting adjustments improved activities in subsequent terms.
• Time on task changed little.
• “Appreciation” changed little.

SLES for DE (and f2f)

Interesting f2f – DE comparisons:

• The text book

• Feedback on completed work

Open feedback from coast fossils activity

Effect of adjustments due to feedback in term 1.

Gray – first feedback
- Mostly “none”
- Term 1 priorities reduced
Time on coast fossils activity

- Time on this task seems little different.
- Possibly shifted to a more uniform 1.5-2.0 hrs. by summer 2015?
  - But summer and fall/winter terms have many reasons to be “different”.

Some references and resources

- http://eos.ubc.ca/about/faculty/F.Jones.html
- http://eos.ubc.ca/research/eawr/