

Earth, Ocean, and Atmospheric Sciences

CWSEI Department Summary

This document summarizes the Earth, Ocean, and Atmospheric Sciences Department's activities as part of the Carl Wieman Science Education Initiative over the years 2007-2019. In this initial version, it replaces a series of web pages that were updated over the lifetime of the CWSEI. It may be updated in future with more detail on impact.

For questions, please contact:

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Overview

Earth, Ocean and Atmospheric Sciences received full funding from CWSEI in 2007 and began the efforts listed below in Summer 2007. The overarching goal of the Department's science education initiative (EOAS-SEI) is to promote cultural change in our approach to teaching and learning and establish sustainable processes to continue and improve the work accomplished during the CWSEI project.

The EOAS-SEI program completed the first phase of CWSEI in 2014 with more than 40 courses either fully transformed or impacted by CWSEI. These courses are now using principles of research-based effective pedagogy in their design and implementation. Many instructors of these courses continue to iterate on improvements either on their own or with consulting help from STLFs. About 80% of EOAS faculty and over half of our sessional instructors have received direct support to adjust their courses and teaching from the SEI so far.

The second phase of the project – the Harris Project – is an extension of CWSEI that runs from 2014 to 2017. In addition to continuing course transformations and faculty support, this phase includes deliberate effort toward effective transfer of pedagogies to new instructors, experimenting with a paired-teaching model. This project is funded by John and Deb Harris, the UBC Faculty of Science, and the Earth, Ocean and Atmospheric Sciences department.

 [Paper \(*Assessment & Evaluation in Higher Education*, 2016\): Impact Assessment of a Department-wide Science Education Initiative using Students' Perceptions of Teaching and Learning Experiences](#)

 [Poster \(Improving University Teaching, 2014\): Comparing Student, Instructor and Observer Data to Assess a 7-Year Department-wide Education Initiative](#)

 [Poster \(CWSEI EOY 2013\): Six Years of SEI in Earth, Ocean and Atmospheric Sciences](#)

 [Poster \(Geological Society of America 2013 Annual Meeting\): Changing the Teaching Culture in a Large Research Oriented Department](#)

 [Poster \(April 2012\): Five Years of SEI in Earth and Ocean Sciences](#)

 [Poster \(April 2009\): EOS-SEI Long-Term Plan, Metadata and Faculty Survey - Sara Harris](#)

The Carl Wieman Science Education Initiative in Earth, Ocean and Atmospheric Sciences touches all aspects of undergraduate teaching and learning in this department. Our undergraduates include those headed for careers in science and many for whom our department is their only encounter with science during their university years. We aim to provide the best opportunities for both these groups to practice scientific thinking and to incorporate scientific skills into their lives, regardless of their career path. We have been developing and using instruments to assess student achievement of learning goals and also their attitudes about science. Our graduate students are involved as an integral part of the undergraduate teaching and learning effort and we have developed a new TA training program to better meet the needs of grad students, undergraduates, and faculty.


Goals

Promote student achievement of the following learning outcomes:

- Develop skills for making reasoned judgments based on scientific evidence and organized knowledge.
- Enhance the ability to transfer knowledge, skills and concepts to new situations or contexts, for professional, academic, or general societal purposes.
- Develop the ability to assess and remedy one's own understanding.
- Achieve an appropriate balance between breadth and depth of knowledge, in order to recognize and express linkages among systems and concepts.
- Explore the interacting frameworks of economic development and environmental stewardship in the richly multi-disciplinary context of earth, ocean, and atmospheric sciences

Expand and coordinate our efforts in the following areas as a department:

- Increase teaching effectiveness and efficiency in our undergraduate courses and programs.
- Raise university-wide levels of scientific literacy and global awareness.
- Emphasize contemporary thought and new directions in science and science education.
- Enable, facilitate, and support faculty and TAs to follow best practices for achieving departmental teaching and learning goals while retaining ownership of their courses.

A copy of our submitted proposal is available here: [EOAS proposal](#)  .

People

CWSEI Dept. Director: Stuart Sutherland, Sara Harris (emeritus)

STLFs: Alison Jolley, Tara Holland, Sarah Bean Sherman, Francis Jones, Brett Gilley, Erin Lane, Joshua Caulkins, Ben Kennedy

Faculty who have worked with STLFs on specific courses: S. Allen, R. Beckie, M. Bevier, M. Bostock, G. Dipple, E. Eberhardt, R. Francois, B. Gilley, E. Haber, S. Harris, F. Herrmann, K. Hickey, S. Hollingshead, T. Ivanochko, M. Jellinek, C. Johnson, F. Jones, L. Kennedy, M. Kopylova, M. Maldonado, U. Mayer, S. McDougall, J. Mortensen, D. Oldenburg, K. Orians, E. Pakhomov, R. Pawlowicz, V. Radic, K. Russell, C. Schoof, J. Scoates, M. Smit, P. Smith, D. Steyn, R. Stull, S. Sutherland, P. Tortell, M. Ver, S. Waterman, D. Weis

Additional Faculty/Instructors impacted by CWSEI: M. Allen, D. Athaide, P. Austin, A. Bain, E. Barns, T. Bissig, A. Caruthers, K. Chan, K. Grimm, L. Groat, P. Hammer, E. Hearn, O. Hungr, D. Jessop, M. Lipsen, L. Longridge, M. McKinnon, J. Monteux, L. Porritt, C. Suttle, .B. VanStraaten, D. Winget, H. Zerriffi, D. Turner, T. Dzikowski

Students contributing to SEI project components: L. Bailey, L. Beranek, J-F. Blanchette-Guertin, G. Baldeon, A. Caruthers, D. Cassis, R. Cockett, J. Dohaney, R. Eso, G. Epstein, L. Greenlaw, M. Golding, L. Gurney, M. Halverson, L. Harrison, S. Henderson, T. Hirsche, K. Hodge, E. Holmes, A. Jolley, K. Ko, P. Lelievre, C. Leslie, C. Livingstone, K. Lucas, J. Mcalister, C. Miller, P. Olmstead, K. Rasmussen, J. Rhajiak, E. Schaeffer, J. Schiller, E. Scribner, I. Shinnick-Gordon, B. Smithyman, K. Smet, L. Stock, R. Taylor, D. Tomkins, D. Tommasi, C. Wong


Activities

Curriculum

Curriculum Planning and course reform

At the curriculum level, we are developing plans for a “Curriculum Matrix” which will explicitly identify links in learning goals among courses, help us identify and remedy gaps, overlaps, and bottlenecks, and serve as a dynamic roadmap for future curriculum evolution.

During this project we will examine curricular goals with increasing detail as more courses become involved. An evolving, dynamic product of this effort will be a three dimensional curriculum matrix with axes of “learning goals”, “courses”, and “years” used to track how core concepts and skills (both cognitive and professional) link among courses. This ongoing exercise will stimulate discussion and allow us to identify and remedy gaps and overlaps in our curricular structure.


 [Poster \(April 2010\): Exit Survey of Graduating EOS Students: Goals and Results - Josh Caulkins](#)

 [Survey of Hiring Practices in Geoscience Industries - Kerry Ko, Francis Jones, Josh Caulkins,](#)

[Sara Harris, Devlin Tompkins \(April 2010\)](#) - Interviews with delegates at the Mineral Exploration Roundup trade show and convention for mining industries to learn about needs and expectations of companies hiring new geoscience graduates.


Status of Curriculum review as of January 2013

- Service Courses Curriculum Committee evaluated precedents, conducted surveys, and analyzed student data to articulate a list of learning goals for all service courses under the subheadings “Knowledge and Major Concepts”, “Skills”, and “Habits and Attitudes”. The list was revised based on faculty input, was presented at the department’s retreat in April 2009, and adopted by the department. Goals are posted on the departmental website.

 [Poster \(April 2009\): Service course curriculum in Earth & Ocean Sciences - Francis Jones](#)

 [Proposed Departmental Goals for Service Courses \(April 2009\)](#)

- Atmospheric Science Curriculum Committee defined program goals. (S. Allen, chair)
- Environmental Science Curriculum Committee conducted student focus groups and extensive data analysis on student enrollment data and developed a set of recommendations and a revised curriculum (D. Steyn, chair)
- Geophysics Curriculum Committee reinstated the Geophysics Majors program (E. Hearn, chair)

 [Results of discussions with the Vancouver professional geophysics community: Geophysics Community Questionnaire Results - Francis Jones \(October 2009\)](#)

- Geology Curriculum Committee reinstated the Geology Majors program. A matrix correlating courses and program objectives is under development (J. Scoates and S. Sutherland).
- Oceanography Curriculum Committee is actively working to define program goals & build links among courses. They have also created two new combined majors in Oceanography programs (with biology and with physics), and a new oceanography minor. (S. Allen, chair)
- Geological Engineering Curriculum Committee has started a course/objectives matrix in anticipation of an upcoming program review.

Exit Survey

An online survey has been developed for graduating 4th year EOAS students from all streams. Data will provide us with student perspectives on the EOAS academic programs, career goals and curriculum recommendations. This information will help us improve our program structure, content, and courses. The survey was initiated in April 2009 and administered annually since then. Results 2009–2014 have been processed and summarized.

Courses

As of May 2016

CWSEI Extension: The Harris Project, 2014-2017

Paired-teaching for faculty professional development, transfer of effective pedagogy, and research:

EOSC 220: Fall '14. New instructor M. Smit paired with experienced instructors J. Scoates and M. Bevier. STLF: T. Holland

ENVR 200: Fall '14. New-to-course instructor H. Zerriffi and experienced instructor T. Ivanochko. STLF: T. Holland

ENVR 300: Spr '15. New-to-course instructor V. Christensen and experienced instructors T. Ivanochko and V. Radic. STLF: T. Holland

ATSC 303: Spr '15. Not-yet-CWSEI instructor R. Howard and experienced instructor R. Stull. STLF: T. Holland

EOSC 112: Fall '15. New instructor S. Waterman and experienced instructor S. Harris. STLF: T. Holland

EOSC 516: Fall '15. New instructor C. Kosman and experienced instructor T. Holland. STLF: S. Sherman

ENVR 200: Spr '16. New-to-course instructor T. Holland and experienced instructor S. Harris. STLF: S. Sherman

EOSC 210: Fall '16. New-to-course instructor S. McDougall and experienced instructors S. Hollingshead and E. Eberhardt. STLF: S. Sherman

Poster, UBC Science Ed. Open House 2016:



[A Paired Teaching Model for Instructor Development: Lessons from the EOAS Department](#)

STLF help with new course transformations:

EOSC 323: Start Jan '15. Faculty: L. Kennedy. STLF: S. Sherman

EOSC 478: Start Jan '16. Faculty: E. Pakhomov and W. Cheung. STLF: T. Holland

STLF help revisiting earlier course transformations:

EOSC 210: Start Apr '15. Faculty: S. Hollingshead and E. Eberhardt. STLF: S. Sherman

EOSC 221: Start Spr '16. Faculty: M. Kopylova. STLF: S. Sherman

EOSC 270: Start Fall '16. Faculty: M. Maldonado, STLF: S. Sherman

STLF help with new course development:

EOSC 240: Start Nov '14. Faculty: S. Hollingshead and several other occasional geological engineering faculty. STLF: T. Holland

EOSC 113: Start May '15. Faculty: R. Stull. STLF: S. Sherman

EOSC 471: Start Fall '16. Faculty S. Allen. STLF: T. Holland

EOSC 448 (temporary course code): Start Fall '16. Faculty C. Johnson. STLF: S. Sherman



Other:




EOSC 472: Nov '14-May '15. Faculty: K. Orians. TA: J. McAlister. Student-generated and peer-reviewed textbook



The Harris Project is funded by John and Deb Harris, the UBC Faculty of Science, and the Earth, Ocean and Atmospheric Sciences Department.


Completed Course Transformations



Course	Learning goals	New Assessments	Improved Methods
<p>EOSC 111: Laboratory Exploration of Planet Earth (Sept '07 - May '11)</p> <p><u>Faculty:</u> Sara Harris <u>STLF:</u> Brett Gilley</p> <p>Ongoing updates to pre-post assessment, lab activities, and quizzes. Course transferred to new instructor (R. Mindel).</p> <p> Poster (GSA, 2011 & CWSEI EOY 2012): Invention Activities in an Introductory Lab: Minerals, Rocks, Biodiversity, & Earthquakes</p>	<p>Course-level goals: complete</p> <p>Lab-level goals: complete</p>	<p>Two-stage (individual & group) quizzes</p> <p>3rd draft of Pre/Post assessment complete for all topics</p> <p>Post-lab surveys for each lab</p> <p>End-of-term survey</p>	<p>Invention activities (Introduction, Minerals, Rocks, Biodiversity)</p> <p>Student-derived methods (Earthquakes, Groundwater, Dinosaurs, Waves, Estuaries)</p>
<p>EOSC 112: The Fluid Earth: Atmosphere and Ocean (Jan '08 - May '14)</p> <p><u>Faculty:</u> Roger Francois, Sara Harris, William Hsieh <u>STLF:</u> Erin Lane</p> <p>Course transferred to various new instructors (V. Radic, E. Pakhomov, D. Steyn, S. Waterman)</p> <p> Poster (CWSEI EOY</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals: complete</p>	<p>Midterm & end-of-term surveys</p> <p>Online quizzes</p> <p>Validated pre-post survey</p> <p>Student engagement observations</p> <p>Student workloads questions</p> <p>Greenhouse effect assessment</p>	<p>Widespread use of thought-provoking clicker questions</p> <p>Relevance slide added to each lecture, relevance added throughout class.</p> <p>Concept sketches and in-class worksheets</p> <p>Two-stage exams</p> <p>Study skills interventions</p>


<p>2009): Climate Science/Oceanography Misconceptions</p>			
<p>EOSC 114: The Catastrophic Earth: Natural Disasters (Sept '07 start)</p> <p><u>Faculty:</u> Roland Stull, Erik Eberhardt, Mary Lou Bevier, Stuart Sutherland, Joel Finnis, Graham Andrews <u>STLF:</u> Francis Jones</p> <p>New in 2010: Introduction of group exams, overseen by Brett Gilley and Roland Stull. Course transferred to various new instructors.</p> <p> Poster (CWSEI EOY 2013): Does collaborative testing increase students' retention of concepts?</p> <p> click here to view course materials.</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals for all lectures: complete</p>	<p>Midterm & end-of-term surveys</p> <p>Pre-course diagnostic on basic skills</p> <p>Online homework based on text readings introduced Fall 2008.</p> <p>Attitudes survey</p> <p>Videos about use of worksheets and 2-stage exams to support professional development of instructors http://blogs.ubc.ca/wpvc/</p>	<p>Course Management System and a custom website used extensively for content delivery, quizzing, surveying, logistics.</p> <p>Use of thought-provoking clicker questions in all lectures</p> <p>Pre-post question “wrappers” around video clips to focus and assess student learning from videos</p> <p>Custom text introduced</p> <p>Off-schedule pre-exam review/question sessions</p> <p>Fall '09: Preliminary experiment with PeerWise in one section. Not continued beyond Fall '09.</p> <p>Multiple sequential instructors with one lead instructor and administrative support.</p> <p>Database of questions with answering analytics prepared based on several years exams</p>


<p>EOSC 210: Earth Science for Engineers (Jan '08 start)</p> <p><u>Faculty:</u> Erik Eberhardt, Ulrich Mayer, Stuart Sutherland <u>STLF:</u> Brett Gilley</p> <p>Course transferred to various new instructors (S. Hollingshead, S. McDougall)</p> <p> Poster (CWSEI EOY 2010): Introduction to Earth Science for Engineers</p> <p> click here to view course materials.</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals: complete</p> <p>Goals for all labs: complete</p>	<p>End-of-term survey</p> <p>Mineral exam</p> <p>Peerwise</p>	<p>Widespread use of clicker questions (4-8 in each 1.5 hour lecture), focus attention, test understanding, and drive discussion</p> <p>Small group or pair discussions in most classes</p> <p>Many case studies relevant to lectures</p> <p>Labs redesigned with new activities linked to learning goals; labs streamlined and reworked over Summer/Fall 2012</p>
<p>EOSC 211: Computer Methods in Earth, Ocean & Atmosph. Sciences (Jan '09 start)</p> <p><u>Faculty:</u> Rich Pawlowicz, Catherine Johnson <u>STLF:</u> Josh Caulkins</p> <p> Poster (CWSEI EOY '10): Transformations and results</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals: complete</p> <p>Learning goals for Labs/Assignments: draft</p>	<p>Pre-post assessment: Administered in Teach 1 and edited for Teach 2, can be used “as is” for all future terms</p> <p>Midterm and end-of-term surveys</p> <p>New types of exam questions based on computer science concepts</p>	<p>In-class worksheets for every lecture</p> <p>Pair-programming used in all labs and assignments.</p> <p>Name-sticks used to call on students during lectures and in-class discussions</p> <p>Post-lecture Interviews</p> <p>Lab interviews</p>
<p>EOSC 212: Topics in the Earth & Planetary Sciences (Jan '08 start)</p>	<p>Course-level goals: complete</p> <p>Focus is on science</p>	<p>End-of-term survey for project evaluation</p> <p>Quizzes on readings for both individual and</p>	<p>Course management system used extensively for content delivery, quizzing, surveying, logistics.</p>



<p><u>Faculty:</u> Mark Jellinek, Michael Bostock <u>STLF:</u> Francis Jones</p> <p>Further refinements of generic science thinking activities and assessments were carried out in Fall '10, primarily by the instructor (M. Jellinek), with minor input and support from F. Jones.</p> <p> Poster (CWSEI EOY 2011): Promoting and Measuring General Scientific Reasoning Expertise of 2nd Year Students</p> <p> click here to view course materials.</p>	<p>thinking skills rather than content</p>	<p>teams, using Team Based Learning strategies.</p> <p>Two projects (presentation and poster), including feedback at multiple stages of delivery.</p> <p>Pre-post test related to model-based reasoning</p> <p>Peer assessment of some homework and both projects</p> <p>Regular graded abstract writing and question-posing assignments</p> <p>Student participation in rubric design for reading, writing and questioning</p>	<p>Team Based Learning elements: permanent teams, individual/team quiz protocols & in-class team activities.</p> <p>Content from Scientific American and other articles and lectures</p> <p>Three modules chosen to highlight Departmental research strengths</p> <p>Guest speakers for each module</p> <p>Instruction and practice at developing science article reading, questioning & discussing skills</p> <p>Project topics are student-determined.</p> <p>Question posing, abstract writing and model based reasoning rubrics are used; in Fall 2010, the question posing aspect was more closely guided so students know whether to ask content or discussion oriented questions.</p> <p>Capstone week introduced to revisit core skills and learning goals.</p>
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			Two instructors with roughly half the classes attended by both
<p>EOSC 220: Introductory Mineralogy (Jan '08 start)</p> <p><u>Faculty:</u> Stuart Mills, Mary Lou Bevier, James Scoates <u>STLF:</u> Ben Kennedy, Joshua Caulkins, Erin Lane, Brett Gilley</p> <p>Additional work by R. Mindel, J. Dohaney; course transferred to various instructors.</p> <p> Poster (CWSEI EOY 2011): Tracking Student Progress with a Mineralogy/Petrology Concept Inventory</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals: complete</p>	<p>Midterm and end-of-term surveys</p> <p>Lab quizzes</p>	<p>In-class activities and discussions are part of each lecture</p> <p>3x5 cards used for student responses and feedback</p> <p>Labs reworked and provided more structure to students and TAs</p> <p>Students create their own reference “mineral book” that can be used later for studying</p> <p>2011-2013: Explicit frameworks and framework activities, and active, group based classroom strategies introduced in a big way. Also strategies for required memorizing introduced. Students now like this course.</p>
<p>EOSC 221: Introductory Petrology (Sept '07 start)</p> <p><u>Faculty:</u> Maya Kopylova <u>STLF:</u> Brett Gilley</p> <p>Course transferred early on to M. Kopylova</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals: complete</p> <p>Lab goals: complete</p>	<p>Pre/post assessment</p>	<p>Labs rewritten - more structure activities linked to goals</p> <p>Small group lecture activities in each lecture</p> <p>3x5 cards for ongoing assessment of students and the course</p>


 click here to view course materials.			<p>Many smaller quizzes after each module</p> <p>Improved course framework (spaced lectures that do more to highlight differences rather than massed lectures, covering all of one rock type).</p>
<p>EOSC 222: Geological Time (Sept '11 start)</p> <p><u>Faculty:</u> Paul Smith <u>STLF:</u> Francis Jones</p>	<p>Course-level goals: first draft completed</p> <p>Module-level (and lab) goals: completed</p>	<p>Weekly lab exercises</p> <p>End of term lab exam</p> <p>In-class activities (next column) serve as formative assessment opportunities.</p>	<p>Roughly half the content was re-worked by P. Smith and R. Mindel.</p> <p>Four of ten labs were re-worked with assistance from an experienced teaching assistant.</p> <p>Complete lecture observations (student engagement plus in-class observations) were conducted during Spring 2011.</p> <p>Roughly 10 in-class group activities for use during class were developed during Spring 2012 teaching term.</p>
<p>EOSC 223: Field Techniques (May '09 start)</p> <p><u>Faculty:</u> Mary Lou Bevier <u>STLF:</u> Josh Caulkins</p>  Poster (CWSEI EOY)	<p>Course level goals: complete</p>	<p>Pre-post assessments and in-field assessments</p>	<p>Increased instructor-student interaction in the field.</p>


<p>2010): EOSC 223: Development and Implementation of an in-field assessment protocol for an introductory geologic field course</p>			
<p>EOSC 252: Intro. to Experimental Geophysics (Sept '09 start)</p> <p><u>Faculty:</u> Felix Herrmann <u>STLF:</u> Francis Jones</p> <p>Transformation project adjourned prior to January 2011 teaching term because the class is no longer offered.</p> <p> click here to view course materials.</p>	<p>Course-level goals: agreed upon</p> <p>Lecture-level goals: first versions</p>	<p>Weekly lab or homework exercises supported by TAs</p> <p>In-class demonstrations assessed for “participation”</p> <p>The beginnings of regular on-line self-test quizzing based on assigned readings. More to come the time the course is taught.</p> <p>Extensive end of term survey about initiatives and preferences.</p>	<p>Enhanced context for all material by:</p> <ol style="list-style-type: none"> 1. Reworked four Lab exercises 2. Re-compiled all lab exercises into a consistent format, which recognizes progression of learning from one exercise to the next. 3. Dropped two labs in favor of a new “capstone exercise” (a context rich exercise using new forms of data (borehole well logs) and lab results from earlier work). 4. Projects involving student-chosen topics, and 3-stage deliverables with TA and peer feedback. 5. Guided demonstrations introduced to four class lectures, including pre-demonstration

			“prediction” worksheets.
<p>EOSC 321: Igneous Petrology (Jan '10 start)</p> <p><u>Faculty:</u> Maya Kopylova <u>STLF:</u> Brett Gilley</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals: complete</p>	<p>End-of-term survey '09 & '10</p> <p>Student focus groups</p> <p>Mineral quizzes, exams, group project</p>	<p>Student focus group</p> <p>Development of several new labs</p> <p>"Wake up" activities in each lecture</p> <p>Distributed mineral quizzes (as opposed to one quiz in week 1).</p> <p>Improved exam creation and marking/grading scheme.</p> <p>Exam questions tied to learning goals.</p> <p>Tectonic setting group project with group contract; in presentations of project, students required to incorporate data presented by other students and come to their own conclusions.</p>
<p>EOSC 322: Metamorphic Petrology (Sept '08 start)</p> <p><u>Faculty:</u> Greg Dipple <u>STLF:</u> Erin Lane</p> <p> Poster (CWSEI EOY 2009): Do You See What I See Pre/Post Assessment</p>	<p>Course level goals: complete</p> <p>Topic-level goals: complete</p>	<p>Midterm survey</p> <p>Pre-reading quizzes</p>	<p>Rock sample and relevance in lectures</p> <p>Just-in-Time-Teaching (pre-readings and online quizzes given prior to module).</p>

<p>EOSC 326: Earth and Life Through Time (Jan '10 start)</p> <p><u>Faculty:</u> Stuart Sutherland <u>STLF:</u> Francis Jones</p> <p>Dec 2012: A video record of one lab and its follow up Friday activity has been developed to support professional development of instructors.</p> <p> Poster (AGU 2012): Fossils, Facies and Geologic Time; Active Learning Yields More Expert-Like Thinking in a Large Class for Senior Science Students</p>	<p>Course-level goals: complete</p> <p>Module-level goals: complete (14 modules) with minor revisions in progress</p>	<p>Pre-requisite self-test, plus corresponding catch up material</p> <p>Weekly online exercises based on assigned readings from text and elsewhere.</p> <p>Regular use of clickers in class</p> <p>Weekly "Active Friday" worksheets (see "Improved Methods")</p> <p>Midterm and final exams plus a comprehensive end-of-term survey</p>	<p>New text to help remove low level content from class</p> <p>Clicker questions are improving as experience is gained.</p> <p>Weekly homework based on assigned readings helps keep students on task. Students do these once for grades, then they are re-opened for practice before exams.</p> <p>Weekly "Active Friday" allows 1/3 of all classes to be 100% peer instruction, active learning. Work is guided, and instructor plus 2 teaching assistants circulate during work.</p> <p>Two hands-on lab exercises substitute for 2 weeks of lectures. Deliverables are completed during class in groups.</p>
<p>EOSC 328: Field Geology (May '10 start)</p> <p><u>Faculty:</u> Ken Hickey, James Scoates <u>STLF:</u> Josh Caulkins</p> <p> Poster (CWSEI EOY 2011): Measuring</p>	<p>Course-level goals: complete</p>	<p>GPS tracking of students, in-field assessments</p> <p>Pre-Post assessments</p> <p>Attitudes assessment</p>	<p>Designed and implemented 2-day "Bootcamp" prior to traveling to field school</p> <p>New mapping exercises</p> <p>Peer-to-peer learning</p> <p>Paced scaffolding</p>

<p>Novices' Field Mapping Abilities Using an In-Class Exercise Based on Expert Task Analysis  (GSA 2010): Geologic Expertise and Field Mapping: Lessons from a 3rd Year Undergraduate Field School</p> <p> Talk (GSA 2014): Mapping For Mastery: Evolution of the University of British Columbia Oliver Field School</p>			<p>(replaced “sink or swim” approach)</p>
<p>EOSC 329: Groundwater Hydrology (Jan '10 start)</p> <p><u>Faculty:</u> Roger Beckie <u>STLF:</u> Francis Jones (current), Josh Caulkins</p>	<p>Course-level goals: complete</p> <p>Module-level goals: draft, need distributing among modules.</p> <p>Learning goals for Labs: complete</p>	<p>Pre-post assessment</p> <p>Clicker questions introduced into nearly all lectures. Weekly labs are taught & marked by TAs. Some lab materials were moved to course management system to improve efficiency and feedback. Weekly TA meetings with the instructor help ensure consistency in all four lab sections.</p> <p>Midterm and final exams, plus a comprehensive end-of-term survey during the transformation process.</p>	<p>Classroom observations and post-lecture interviews were carried out early in the transformation process</p> <p>Lab exercises were substantially refined and aligned with learning goals, and expectations have been made more explicit</p> <p>TAs have well developed guidance for instructing and running labs</p> <p>Introduced three case studies to correspond with lab work</p> <p>Some small group work during lectures</p> <p>Clickers added to all</p>

			lectures to help leverage Socratic teaching to advantage all students
<p>EOSC 331: Introduction to Mineral Deposits (Jan '10 start)</p> <p><u>Faculty:</u> James Scoates, Ken Hickey <u>STLF:</u> Brett Gilley</p> <p> Poster (CWSEI EOY 2012): 3 years of Improving Student Impressions of EOSC 331</p> <p> Poster (GSA 2014): Transforming An Upper-Year Mineral Deposits Class Through Interactive Engagement</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals: complete</p> <p>Lab-level goals: complete</p>	<p>End-of-term survey</p> <p>Sketches in first and last labs</p> <p>Smaller quizzes replace midterms</p>	<p>New course frameworks developed</p> <p>Reduced length of midterms, inserted framework activity after each quiz</p> <p>Activities in many lectures</p> <p>Rewrote all labs; labs now have "checkpoints" and are handed in at the end of lab</p> <p>How does a geologist sketch activity</p> <p>Poster session activity - successful model; developed poster rubric</p> <p>Summative "deposits in space & time" activity</p> <p>Improved final exam format</p> <p>Work has continued past "official" transformation; many more activities</p>
<p>EOSC 332: Tectonic Evolution of North America (Sept '08 start)</p>	<p>Course-level goals: draft</p> <p>Module-level goals: draft</p>	<p>Pre/Post Assessment rewritten for Jan 2010 (validated with former students)</p>	<p>Activities and discussions planned for some lectures</p> <p>Just-in-Time-Teaching</p>

<p><u>Faculty:</u> James Mortensen <u>STLF:</u> Brett Gilley</p> <p>Course Transferred to E. Barnes for one semester</p>		<p>Midterm survey</p> <p>Peer Review Essay assignment</p> <p>End-of-term survey</p>	<p>(pre-readings and online quizzes given prior to each module)</p>
<p>EOSC 355: The Planets (Sept '08 start)</p> <p><u>Faculty:</u> Catherine Johnson <u>STLF:</u> Francis Jones</p> <p>New course, taught 1st time in Spring 2009.</p> <p>Fall 2010: incorporation of a second instructor supported and observed by STLF as a “transfer” and sustainability experiment.</p> <p> Poster (CWSEI EOY 2010): Continuing development of in-class activities in an upper level science elective</p>	<p>Course-level goals: complete</p> <p>Module-level goals: finalized for Spring 2010 term.</p>	<p>Pre-course skills diagnostic and “attitudes toward planetary sciences”</p> <p>Midterm survey for improving course delivery and focus</p> <p>Frequent in-class quizzes</p> <p>Clickers, major capstone homework exercises for each of 3 modules, in-class team-based worksheets used to set up or practices lecture content and skills.</p> <p>Major project, including 3-stage deliverables, and peer assessment.</p> <p>No final exam</p>	<p>Course management system used for content delivery, quizzing, surveying, logistics</p> <p>Use of permanent teams for quizzes and in-class worksheet-based activities</p> <p>Clickers used for pre-lecture prediction and mid-lecture discussions.</p> <p>Online and in-class quizzes, especially to ensure accountability and assess comprehension of basic content, thus permitting higher level in-class activities & lectures.</p> <p>Major poster presentation projects are a primary source of grades. Logistical strategies were adjusted to better meet student needs and improve logistical efficiency in 2013.</p>
<p>EOSC 372: Introductory Oceanography: Circulation and Plankton (Jan '09 start)</p>	<p>Course-level goals: complete</p> <p>Lecture-level goals:</p>	<p>Mid-term & end-of-term surveys</p> <p>Daily online quizzes</p>	<p>Widespread use of thought-provoking clicker questions</p>

<p><u>Faculty:</u> Susan Allen, Kristin Orians, Maria Maldonado, Erin Lane <u>STLF:</u> Erin Lane</p>	<p>complete Assignment learning goals: complete</p>	<p>Pre-requisite knowledge diagnostic quiz Draft post test Student workloads questions</p>	<p>Daily assignments with online quizzes In class demonstrations and analogies developed</p>
<p>EOSC 373: Introductory Oceanography: Climate and Ecosystems (Sept '09 start) <u>Faculty:</u> Maria Maldonado, Susan Allen, Roger Francois, Erin Lane <u>STLF:</u> Erin Lane</p>	<p>Course-level goals: complete Lecture-level goals: complete</p>	<p>Mid-term survey Draft diagnostic test Daily online quizzes</p>	<p>Widespread use of thought-provoking clicker questions Daily assignments with online quizzes</p>
<p>EOSC 472: Introduction to Marine Chemistry and Geochemistry (Sep '09 start) <u>Faculty:</u> Kristin Orians <u>STLF:</u> Joshua Caulkins</p>	<p>Course-level goals: complete, editing for new content Lecture-level goals: draft, editing for new content</p>	<p>Midterm and end-of-term surveys Reading quizzes introduced Reworked homework sets Term papers enhanced to be a "critical review paper" which includes greater depth of comprehension</p>	<p>Weekly worksheet activities Anonymous peer-reviewed writing assignment with instructor feedback Post-lecture student interviews Investigating new textbook options, perhaps introducing a packet of articles name sticks used during lectures</p>

The following courses have undergone improvement with minor STLF support

EOSC 110: In-class worksheets and clickers. Used the Geoscience Concept Inventory to measure student learning - Faculty: M. Bevier, L. Porritt

EOSC 116: In-class worksheets and clickers. Pre-post testing. Faculty: S. Sutherland, M. Golding, J.

Mortensen, S. Sherman. STLF: F. Jones

EOSC 118: Activities in the online setting (offered only as Distance Education). Faculty: D. Turner, T. Dzikowski, STLF: B. Gilley

ATSC 201: Just-in-Time Teaching and clickers - Faculty: R. Stull


EOSC 250: Active classes and Socratic lectures – Faculty: C Schoof, STLF: B. Gilley

EOSC 270: Two homework exercises that use UBC's Beaty Museum of biodiversity for synthesis of principle concepts, early and late in the course. M. Maldonado, E. Pakhomov, F. Jones and a grad student. Results assessed, minor adjustments made, and exercises are now permanent part of the course.

EOSC 315: Clickers (one year only) - Faculty: M. Lipsen

EOSC 324: No longer offered - Faculty M. Bevier

EOSC 333: Learning goals, in class activities, field trips, labs summative activities, STLF: B. Gilley


EOSC 340: Just-in-Time Teaching, clickers, worksheets, two-stage exams - Faculty: S. Harris, P. Austin, T. Ivanochko.  [Talk \(GSA 2014\): University Students' Ideas About Climate Concepts Lack Systems Dynamics Thinking](#)


EOSC 350: Team Based Learning - Faculty: D. Oldenburg, STLF: F. Jones

EOSC 352: Active classes and Socratic lectures – Faculty: C Schoof, STLF: B. Gilley

EOSC 420: Developing lab activities and student conference on projects. Faculty: K Russell, L. Porritt. STLF: B. Gilley

EOSC 421: Lab projects, lecture activities, and field trip Faculty: A. Caruthers, STLF: B. Gilley

EOSC 424: Learning goals, activities, labs, and projects Faculty: J. Scoates and K. Hickey, STLF: B. Gilley.  [Talk \(CWSEI EOY 2012\): Transforming Teaching in Geology](#)

EOSC 433: Scaffolding exercises for design and reporting on design projects, and a peer assessment of intermediate work. E. Eberhardt, F. Jones, and a grad student.  [Talk \(U. Calgary, 2014\): Improving and Assessing Research, Design and Reporting Skills of STEM Students](#)

EOSC 442: Lab projects. Faculty: T. Ivanochko. STLFs: F. Jones & B. Gilley

EOSC 445: Active class; project management. Faculty: S. Hollingshead. STLF: F. Jones

EOSC 450: Student projects. Faculty: C. Johnson. STLF: F. Jones

EOSC 474: Group e-posters. Faculty: E. Pakhomov. STLF: B. Gilley

EOSC 478: Eposter project and online poster session. Faculty: E. Pakhomov, STLF: B. Gilley


ENVR 200: Team projects, studying metacognition - Faculty: K. Chan, S. Harris, T. Ivanochko, M. Johnson, D. Steyn


ENVR 300: Team projects - Faculty: K. Chan, T. Ivanochko, V. Radic, D. Steyn

Related projects:

Enhancing Distance and Face-to-face Education: A two year post-CWSEI project funded by UBC's Flexible Learning Initiative (2014-2016). This project builds directly upon gains made during the EOAS-SEI to improve courses offered in both distance education and face to face modes.

Teaching, Learning, and Assessing Scientific Reasoning Abilities in large Face-to-face and Online Courses: A two-year post-CWSEI project funded by UBC's Teaching and Learning Enhancement Fund (2016-2018). This project builds on work from EOAS-SEI and the previous Flexible Learning project.

 [Sara Harris's poster presentation: Engaging non-science students in large classes](#) at the December 2008 American Geophysical Union conference in San Francisco on changes in EOSC 310 - The Earth and the Solar System.

 [Francis Jones' poster presentation: Improving Metacognitive Skills of 2nd year Environmental Science Students: What to Measure?](#) at the Nov. 2008 workshop on the Role of Metacognition in Teaching Geoscience at Carleton College.

General Principles

For each targeted course, instructors will collaborate with instructional designers, IT specialists, the EOS-SEI project committee, and CWSEI (the Carl Wieman Science Education Initiative) to achieve the following goals.


- Identify measurable learning goals appropriate for the types of students targeted by the course. Goals may address any combination of general science literacy, key disciplinary knowledge, and cognitive skills.
- Define prerequisite knowledge for incoming students.
- Provide opportunities for students to identify and remedy their level of preparation. This includes design and development of interactive review modules addressing key concepts and skills. Students will be able to self-assess their individual level of preparation for the course. Discussions with other departments will be included as needed.
- Design and develop interactive learning tools to improve effectiveness of learning. Examples include research games and simulation models of different aspects of the Earth system.
- Identify engaging, proven teaching practices that will best serve the class size and target audience while achieving learning objectives. We will use available tools and expertise on and off campus (e.g. WebCT, the Office of Learning Technology (OLT), the Centre for Teaching and Academic Growth (TAG)), innovate where appropriate, test innovations, and tap expertise within CWSEI and Skylight for ideas from the science education literature.
- Identify commonly challenging concepts, and provide opportunities for students to grapple with them and practice the skills they are expected to master.
- Design, test, and implement objective assessments (formative and summative) that measure student understanding of earth, ocean, and atmospheric science concepts including broad topic areas such as “ fields”, “fluxes”, and “complex systems”.
- Incorporate common misconceptions into assessments and structure assessments to reveal information about cognitive skill development, e.g., the ability to transfer concepts to new situations.
- Track results over time to gauge effectiveness of new techniques.

Assessment Tools

Information below relates to broad assessment tools that are not course-specific. There are also numerous assessment tools being developed and implemented for specific courses (see the [Course Transformation page](#)).


Student Perceptions about Earth Sciences Survey (SPESS)

We developed a survey to gauge the students' perceptions about learning earth, ocean & atmospheric sciences. Administered in both majors- and non-majors courses early in the term (pre-) and late in the term (post-) to measure the effects of courses on student attitudes. The survey has been administered in >25 courses both at UBC and other institutions. More than 6000 students have participated. SPESS has been fully validated by expert responses and student interviews. The survey consists of 29 statements, which have been grouped in seven categories based on reduced basis factor analysis from student survey responses.

 [SPESS: A New Instrument For Measuring Student Perceptions In Earth and Ocean Science](#) - Alison Jolley, Erin Lane, Ben Kennedy, Tom-Pierre Frappé, Journal of Geoscience Education, Vol. 60, pp. 83–91 (2012).


Measuring student engagement

We developed an objective, quantitative classroom observation protocol to measure student engagement in a large first year Oceanography course. Observation data show that student engagement is strongly correlated to teaching practices and is higher when instructors employ active learning techniques. Observations of three instructors with different teaching expertise showed similar trends in engagement. The classroom observation data help identify best teaching practices and provide continual feedback to instructors.

 [Paper \(2015\): A New Tool for Measuring Student Behavioral Engagement in Large University Classes](#), Erin Lane and Sara Harris, Journal of College Science Teaching, Vol. 44(6), pp. 83-91 (2015).

Midterm and End of Term Student Surveys

This project is aimed at sharing what we learn about the best ways of asking and using student feedback. Evidence-based teaching means searching for ways evaluating how well teaching efforts are helping students learn, AND reacting to what is discovered. As the EOAS Science Education Initiative progresses, we are constantly trying to improve the usefulness of feedback requested and received from students.

 [Poster \(July 2009\): Design and Use of Midterm and End of Term Student Surveys to Improve Learning - Francis Jones](#); presented at The International Conference on Improving University Teaching (IUT), Vancouver BC, July 14-17, 2009.

Exit Survey

An online survey has been developed for graduating 4th year EOAS students from all streams. Data will provide us with student perspectives on the EOAS academic programs, career goals and curriculum recommendations. This information will help us improve our program structure, content, and courses. The survey was initiated in April 2009 and administered annually since then. Results 2009–2014 have been processed and summarized.

Teaching Assistants Development

A primary project objective is to enable, facilitate, and support faculty and teaching assistants (TAs) to follow best practices for achieving departmental teaching and learning goals while retaining ownership

of their courses. Towards that end, the project will learn what other units and departments are doing to support development of graduate students as teaching assistants, and then develop efficient and effective TA training modules for the earth ocean and atmospheric sciences context.

Training graduate students in best teaching practices will not only help our undergraduates and faculty, but will also improve the effectiveness of teaching that graduate students become involved when they finish their degrees and enter the work force elsewhere.


EOAS 516: Teaching and Learning in Earth & Ocean Sciences

We have established a TA training course for graduate students. The course is run primarily by graduate students who have facilitator training. Enrolment is about 15/year.

Learning goals: Course level goals, Learning goals for each session

Assessments: Using Physics' Teaching Attitudes Survey as Pre/Post, Formative Evaluation after each session, Summative Evaluation, Beliefs about Reformed Science Teaching and Learning Survey (BARSTL)

Methods and materials: Mini-lesson practice, Group discussions, Lab redesign project

 [Poster \(April 2010\): Teaching and Learning in the Earth and Ocean Sciences: Adding Geoscience Education to the Graduate Student Curriculum at UBC - Rebecca Taylor and Brett Gilley](#)

Research

See eoas.ubc.ca/research/cwsei/research.html for a complete list of previous and continuing projects.

See eoas.ubc.ca/research/cwsei/resources/research/eossei-ResearchList.pdf for a complete list of research results from EOAS-SEI 2007-2014, including peer-reviewed publications, undergraduate honors theses, and conference presentations.

Student thinking about climate concepts

Sara Harris, collaborators Anne Gold, Jane Schoonmaker, Stephen Taylor, and student Isabel Shinnick-Gordon have been studying students' ideas about climate concepts.

 [Talk \(GSA 2014\): University Students' Ideas about Climate Concepts Lack Systems Dynamics Thinking](#)


 [Poster \(CWSEI EOY 2014\): Student Mental Models of the Greenhouse Effect](#)

 [Poster \(CWSEI EOY 2014\): Climate Change Education: Validation of assessment questions and retention of concepts](#)

Workloads and enthusiasm study

Relative and absolute workloads in 25 courses were collected between 2009 and 2014, with densest data in 2009-2011. Results are being summarized and analyzed with the intent to publish. Relative workloads and relative enthusiasm data in nearly all undergraduate courses were collected for the 2013-2014 academic year.

Student Perceptions of Learning study

The  [Students' Learning Experiences Survey](#) (SLES) was developed by the UBC Department of Earth, Ocean and Atmospheric Sciences CWSEI program and deployed in 48 EOAS undergraduate courses taught in fall 2013 and spring 2014 as part of the impact assessment of the CWSEI. Results based on 2489 student respondents in these courses (representing 4871 enrolled students) are reported in "Impact Assessment of a Department-wide Science Education Initiative using Students' Perceptions of Teaching and Learning Experiences" by Francis Jones, in the journal *Assessment & Evaluation in Higher Education*, 2016. <http://dx.doi.org/10.1080/02602938.2016.1188057>, (preprint [available here](#))

 [Students' Perceptions of Teaching & Learning Experiences after 7 years of CWSEI support](#), Francis Jones poster at the UBC Science Education Open House (April 2016)

Videos of exemplary STEM teaching strategies

Seven short clips produced to help faculty and students new to research-based instructional practices visualize what it's like to teach and learn in transformed courses. See <http://blogs.ubc.ca/wpvc/>.

Impact assessment

After 7 years of CWSEI support, we are now measuring effectiveness and efficiency of learning and teaching strategies by gathering data from three complementary perspectives: (i) measures of learning, (ii) student & instructor perceptions, and (iii) course observations. Each perspective is being examined in terms of both current practices and changes in practices since 2007.

Case Study of Transformative Educational Change

Carried out September 2014 by Huber and Hutchings: Huber, Mary Taylor, and Hutchings, Pat. 2014. The Carl Wieman Science Education Initiative in Earth, Ocean, and Atmospheric Sciences, University of British Columbia: Benchmark Report. A Bay View Alliance Case Study. (Unpublished manuscript, Fall 2014).

Enhancing Distance and Face-to-face Education

Enhancing Distance and Face-to-face Education: A two year post-CWSEI project funded by UBC's Flexible Learning Initiative (2014-2016). This project builds directly upon gains made during the EOAS-SEI to improve courses offered in both distance education and face to face modes.


Teaching, Learning, and Assessing Scientific Reasoning Abilities in large Face-to-face and Online Courses:

A two-year post-CWSEI project funded by UBC's Teaching and Learning Enhancement Fund (2016-2018). This project builds on work from EOAS-SEI and the previous Flexible Learning project.

Landscape Identification and Formation


Upper level students at UBC decreased in their confidence with timescales of landscape formation at the end of the term, as measured by the Student Attitudes about Earth Science Survey (SAESS). In order to further investigate this result, the Landscape Identification and Formation Test (LIFT) has been developed. Students view images of various landscapes, identify them, answer a multiple choice question on the time it took to form, and rate their confidence in their answers. The understanding of deep time and interpretation of landscapes is vital to the skill set of the geologist. Both the attitudes and confidence of students greatly impact the learning process, and the results of the LIFT can be used to understand it in greater detail.

[Undergraduate Thesis \(April 2010\): Identifying Landscapes and their Formation Timescales: Comparing Knowledge and Confidence of Beginner and Advanced Geoscience Undergraduate Students - Alison Jolley](#)

 [Poster \(August 2009\): Landscape Identification and Formation: The Development of a Test to Measure Student Knowledge and Confidence - Alison Jolley](#)


Student Perceptions about Earth Sciences Survey (SPSS)

We developed a survey to gauge the students' perceptions about learning earth, ocean & atmospheric sciences. Administered in both majors- and non-majors courses early in the term (pre-) and late in the term (post-) to measure the effects of courses on student attitudes. The survey has been administered in >25 courses both at UBC and other institutions. More than 6000 students have participated. SPSS has been fully validated by expert responses and student interviews. The survey consists of 29 statements, which have been grouped in seven categories based on reduced basis factor analysis from student survey responses.

 [SPSS: A New Instrument For Measuring Student Perceptions In Earth and Ocean Science](#) - Alison Jolley, Erin Lane, Ben Kennedy, Tom-Pierre Frappé, Journal of Geoscience Education, Vol. 60, pp. 83–91 (2012).


Measuring student engagement

We developed an objective, quantitative classroom observation protocol to measure student engagement in a large first year Oceanography course. Observation data show that student engagement is strongly correlated to teaching practices and is higher when instructors employ active learning techniques. Observations of three instructors with different teaching expertise showed similar trends in engagement. The classroom observation data help identify best teaching practices and provide continual feedback to instructors.

 [Paper \(2015\): A New Tool for Measuring Student Behavioral Engagement in Large University Classes](#), Erin Lane and Sara Harris, Journal of College Science Teaching, Vol. 44(6), pp. 83-91 (2015).

Understanding Geological Time

Having a firm grasp of geological time is essential to developing a full understanding of the Earth. The proposed 20 question, mainly multiple-choice, assessment mechanism is designed to probe the understanding of geological time amongst beginner (entry-level college) and advanced (graduating) students in a major's geology program. From validation interviews students displayed gaps in their understanding of geoscience terminology and a lack of technical vocabulary when reasoning questions out-loud. The implementation of this assessment should aid in development of the geology curriculum within the Department of Earth Ocean and Atmospheric Sciences at UBC by giving instructors a snapshot of student understanding of geological time.


 [Poster \(April 2009\): Understanding Geological Time: A Proposed Assessment Mechanism for Beginner and Advanced Geology Students at UBC - Jamil Rhajjak](#)

 [Undergraduate Honours Thesis - Jamil Rhajjak](#)

Do Critical Incidence Questionnaires Promote Metacognition?

Critical Incidence Questionnaires (CIQs) have been used for a couple of years, but in spite of literature promoting their use, we are not sure if they help students make measurable gains in metacognitive abilities. We are not even sure how to measure increases in metacognition. This project is an exploration of both those questions in the context of our Environmental Sciences course ENVR 200. In this course, CIQs are answered weekly by all students, and contain a few questions like: What about the class this week surprised you the most?

 [Seminar \(Oct 2008\): Keeping the feedback loop active: Critical incidents for learning - Sara Harris & Douw Steyn](#)

 [Poster \(Nov 2008\): Improving Metacognitive Skills of 2nd year Environmental Science Students: What to Measure?](#) at the workshop on the Role of Metacognition in Teaching Geoscience at Carleton College - Francis Jones, Sara Harris, and Douw Steyn

Other Research

Effects of multiple instructors in single courses; using pair programming in EOSC 211; pre-post test results from various courses; impacts of group exams; effects of instructor interventions on low-performing students; developing field expertise; developing scientific thinking skills; student workloads and comparative workloads; changes in student evaluations.

Newsletters

The monthly newsletter aims to keep all faculty, staff and students up to date with our work. Topics relating to results of research into learning in our courses, pointers for "best practices", observations about curriculum or pedagogy will be covered.

Archive of the newsletter, "EOS SEI Times", 2008-2017:

<https://www.eoas.ubc.ca/research/cwsei/eossei-times.html>

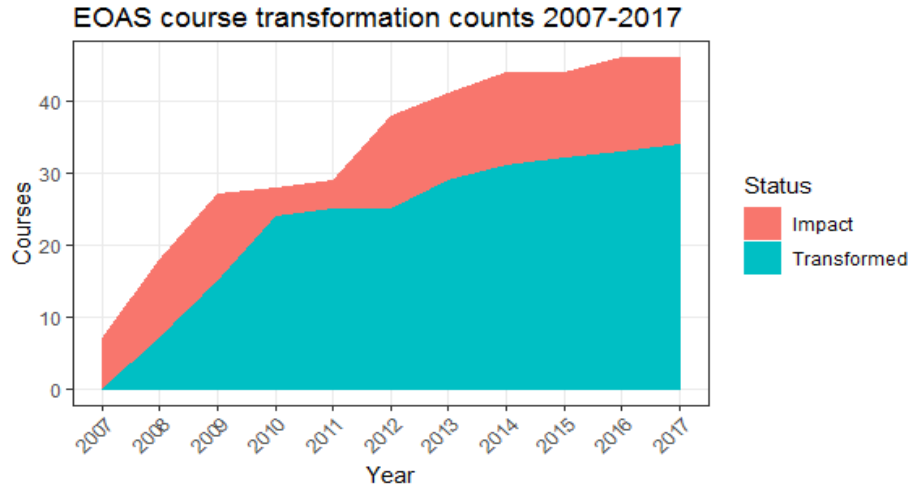
Impact

EOAS: Skylight and CWSEI Course Impact Update for 2018

Found 211 projects total. Found 202 projects with courses not cancelled. This includes known new courses for the coming year (not counted in impact numbers below). Restricting to EOAS courses leaves 47 project courses.

Transformed course counts

As of Spring 2018, we had 46 courses taught by EOAS that had had direct CWSEI influence:









Impact in terms of seats/registrations

We can look at this in terms of the **67 undergraduate courses offered by EOAS in 2017** with LEC, LAB or DST as primary activity and excluding distance ed. sections. In terms of **seats/registrations** (with LEC, LAB or DST as primary activity; excludes distance ed. sections):

EFFECT	Seats.2012	Seats.2013	Seats.2014	Seats.2015	Seats.2016	Seats.2017
	Transformed	4552	4666	4668	4958	4519
Impact	396	489	627	569	603	590
Other/None	861	928	832	850	881	1154
EFFECT	Prop.Seats.2012	Prop.Seats.2013	Prop.Seats.2014	Prop.Seats.2015	Prop.Seats.2016	Prop.Seats.2017
Transformed	78.4%	76.7%	76.2%	77.7%	75.3%	71.9%
Impact	6.8%	8.0%	10.2%	8.9%	10.0%	9.5%
Other/None	14.8%	15.3%	13.6%	13.3%	14.7%	18.6%







Publications and Presentations







<div style="background-color: #e0e0ff; border-radius: 10px; padding: 2px 5px; display: inline-block;">Paper</div>	Comparing student, instructor, classroom and institutional data to evaluate a seven-year department-wide science education initiative Francis Jones (Earth, Ocean & Atmospheric Sciences, UBC)	full access link
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	Assessment & Evaluation in Higher Education (2017), DOI: 10.1080/02602938.2017.1343799	
Paper	Impact assessment of a department-wide science education initiative using students' perceptions of teaching and learning experiences Francis Jones (Earth, Ocean & Atmospheric Sciences, UBC) Assessment & Evaluation in Higher Education (2016), DOI: 10.1080/02602938.2016.1188057	restricted access link  preprint
Paper	A New Tool for Measuring Student Behavioral Engagement in Large University Classes Erin Lane and Sara Harris (Earth, Ocean & Atmospheric Sciences, UBC) Journal of College Science Teaching, Vol. 44(6), pp. 83-91 (2015)	
Paper	Collaborative Testing: Evidence of Learning in a Controlled In-Class Study of Undergraduate Students Brett Gilley (Earth, Ocean & Atmospheric Sciences, UBC) and Bridgette Clarkston (Life Sciences, UBC) Journal of College Science Teaching, Vol. 43, No. 3, pp. 83-91 (2014)	
Paper	Measuring Student Knowledge of Landscapes and Their Formation Timespans Alison Jolley, Francis Jones, Sara Harris (Earth, Ocean & Atmospheric Sciences, UBC) Journal of Geoscience Education, Vol. 61, pp. 240–251 (2013)	
Paper	Benefits and Drawbacks of Using Multiple Instructors to Teach Single Courses Francis Jones and Sara Harris (Earth and Ocean Sciences, UBC) College Teaching, 60: pp. 132–139, (2012)	
Paper	SPESS: A New Instrument For Measuring Student Perceptions In Earth and Ocean Science Alison Jolley, Erin Lane, Ben Kennedy, Tom-Pierre Frappé (Earth and Ocean Sciences, UBC)	

	Journal of Geoscience Education, Vol. 60, pp. 83–91 (2012)	
Paper	Successful Curriculum Development and Evaluation of Group Work in an Introductory Mineralogy Laboratory Jacqueline Dohaney, Erik Brogt, and Ben Kennedy (Earth and Ocean Sciences, UBC) Journal of Geoscience Education, Vol. 60, pp. 21-33 (2012)	
Paper	Industry Input Contributes to Geology Curriculum Review Francis Jones (Earth and Ocean Sciences, UBC) Innovation, March/April 2012, pp. 16-17	
Paper	Performance on the Geologic Spatial Visualization Survey: A Comparison Between Junior and Senior Undergraduate Students Carrie Wong (Earth and Ocean Sciences, UBC) Undergraduate Thesis (2011)	To view full text
Paper	Identifying Landscapes and their Formation Timescales: Comparing Knowledge and Confidence of Beginner and Advanced Geoscience Undergraduate Students Alison Jolley (Earth and Ocean Sciences, UBC) Undergraduate Thesis (2010)	To view full text
Paper	Understanding Geological Time: A Proposed Assessment Mechanism for Beginner and Advanced Geology Students at UBC Jamil Rhajiak (Earth and Ocean Sciences, UBC) Undergraduate Thesis (2009)	To view full text
Poster	Investigating a Paired Teaching Model for Transfer of Evidence-Based Teaching Practices Tara Holland (EOAS, UBC) Earth Educators' Rendezvous, Boulder, CO (July 2015)	
Talk	Mapping for Mastery: Evolution of the Oliver Field School, University of British Columbia	

	<p>Joshua Caulkins, Kenneth Hickey, James Scoates, and Sara Harris (EOAS, UBC)</p> <p>Geological Society of America (GSA) Annual Meeting, Vancouver, BC (Oct 2014)</p>	
Talk	<p>University Students' Ideas about Climate Concepts Lack Systems Dynamics Thinking</p> <p>Sara Harris, Jane Schoonmaker, Stephen Taylor (EOAS, UBC; University of Hawaii; Kauai Community College)</p> <p>Geological Society of America (GSA) Annual Meeting, Vancouver, BC (Oct 2014)</p>	
Poster	<p>Transforming An Upper-Year Mineral Deposits Class Through Interactive Engagement</p> <p>Brett Gilley, James S. Scoates, Kenneth A. Hickey (EOAS, UBC)</p> <p>Geological Society of America (GSA) Annual Meeting, Vancouver, BC (Oct 2014)</p>	
Poster	<p>Comparing Student, Instructor and Observer Data to Assess a 7-Year Department-wide Education Initiative</p> <p>Francis Jones, Sara Harris, & Brett Gilley (EOAS, UBC)</p> <p>International Improving University Teaching conference, Vancouver BC (July 2014)</p>	
Talk	<p>Videos for Supporting Faculty Adoption of Research Based Instructional Strategies in science courses</p> <p>Francis Jones (EOAS, UBC) & Tom Scott (CTLT, UBC)</p> <p>International Improving University Teaching conference, Vancouver BC (July 2014)</p>	
Talk	<p>Improving and Assessing Research, Design and Reporting Skills of STEM Students</p> <p>Francis Jones, Geidy Baldeon, & Erik Eberhardt (EOAS, UBC)</p> <p>University of Calgary Conf. on Postsecondary Learning & Teaching (May 2014)</p>	

<p>Talk</p>	<p>Measuring University students’ understanding of the greenhouse effect – a comparison of multiple-choice, short answer and concept sketch assessment tools with respect to students’ mental models Anne Gold (CIRES, CU) & Sara Harris (EOAS, UBC)</p> <p>American Geophysical Union Fall Meeting, San Francisco, CA (Dec 2013)</p>	
<p>Talk</p>	<p>Student Mental Models of the Greenhouse Effect: Retention Months After Interventions Sara Harris (EOAS, UBC) & Anne Gold (CIRES, CU)</p> <p>American Geophysical Union Fall Meeting, San Francisco, CA (Dec 2013)</p>	
<p>Talk</p>	<p>University students’ mental models of the greenhouse effect: A comparison of two learning activities in moving students toward expert thinking Sara Harris (EOAS, UBC) & Anne Gold (CIRES, CU)</p> <p>Geological Society of America (GSA) Annual Meeting, Denver, CO (Oct 2013)</p>	
<p>Poster</p>	<p>Changing the Teaching Culture in a Large Research Oriented Department Brett Gilley, Francis Jones, Sara Harris (Earth, Ocean & Atmospheric Sciences, UBC)</p> <p>Geological Society of America (GSA) Annual Meeting, Denver, CO (Oct 2013)</p>	
<p>Poster</p>	<p>Fossils, Facies and Geologic Time; Active Learning Yields More Expert-Like Thinking in a Large Class for Senior Science Students Stuart Sutherland & Francis Jones (Earth, Ocean and Atmospheric Sciences, UBC)</p> <p>American Geophysical Union (AGU) Meeting, San Francisco, CA (December 2012)</p>	
<p>Poster</p>	<p>“Invention” Activities in an Introductory Lab: Minerals, Rocks, Biodiversity, & Earthquakes Sara Harris & Brett Gilley (Earth and Ocean Sciences, UBC)</p>	

	Geological Society of America (GSA) Annual Meeting, Minneapolis, MN (Oct 2011)	
Talk	Teaching, learning and assessing scientific skills early in an undergraduate degree Francis Jones (Earth and Ocean Sciences, UBC) Western Conference on Science Education, U. Western Ontario (July 2011)	
Talk	Measuring novices' field mapping abilities using an in-class exercise based on expert task analysis Joshua Caulkins (Earth and Ocean Sciences, UBC) American Geophysical Union (AGU) Annual Meeting, San Francisco, CA (December 2010)	
Poster	Geologic Expertise and Field Mapping: Lessons From a 3rd Year Undergraduate Field School Joshua Caulkins (Earth and Ocean Sciences, UBC) Geological Society of America (GSA) Annual Meeting, Denver, CO (November 2010)	
Poster	Landscape Identification and Formation: The Development of a Test to measure Student Knowledge and Confidence Alison Jolley (Earth and Ocean Sciences, UBC) Western Inter-University Geosciences Conference (January 2010)	
Poster	A New Tool for Investigating Undergraduate Attitudes about Earth Science Alison Jolley and Erin Lane (Earth and Ocean Sciences, UBC) Geological Society of America (GSA) Annual Meeting, Portland, OR (October 2009)	
Poster	Development and Implementation of an In-Field Assessment Protocol for an Introductory Geologic Field Course Mary Lou Bevier and Joshua Caulkins (Earth and Ocean Sciences, UBC)	

	Geological Society of America (GSA) Annual Meeting, Portland, OR (October 2009)	
Poster	Clickers: can a simple technology increase student engagement in the classroom? Erin Lane (Earth and Ocean Sciences, UBC) International Conference on Information Communication Technologies in Education (ICICTE), Corfu, Greece (July 2009)	
Poster	Quantifying student behavioral engagement based on teaching practices in a large class - Awarded "Best Poster" Erin Lane and Sara Harris (Earth and Ocean Sciences, UBC) Improving University Teaching (IUT) 34th International Conference, Vancouver, BC (July 2009)	
Poster	Engaging non-science students in large classes Sara Harris (Earth and Ocean Sciences, UBC) American Geophysical Union Conference (December 2008)	
Poster	Improving Metacognitive Skills of 2nd year Environmental Science Students: What to Measure? Francis Jones, Sara Harris, and Douw Steyn (Earth and Ocean Sciences, UBC) Workshop on the Role of Metacognition in Teaching Geoscience at Carleton College (November 2008)	
Poster	Measuring Student Gains in an Introductory Geoscience Lab Brett Gilley and Sara Harris (Earth and Ocean Sciences, UBC) Geological Society of America Annual Meeting, Houston (October 2008)	

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