



Teaching and Learning in the Earth and Ocean Sciences: Adding Geoscience Education to the Graduate Student Curriculum at UBC



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ABSTRACT To address the lack of both Teaching Assistant training and the support of teaching skill development in graduate students, the Department of Earth and Ocean Sciences at the University of British Columbia began a graduate course, entitled Teaching and Learning in the Earth and Ocean Sciences, in 2007. This course is based on the Instructional Skills Workshop model in that students have the opportunity to teach three mini-lessons and receive feedback from their peers. In addition, topics of learner-centered pedagogy are explored throughout the semester and the course culminates in a lab redesign project. Pre- and Post-course Teaching Attitude surveys show a substantial increase in teaching confidence. Course evaluations indicate that the course is both popular and effective; in the three years the course has been offered, all participants that filled out the summative evaluation forms say they will recommend it to other students. Going forward, this course will continue to develop the confidence and instructional skills of the teachers who spend the most time with undergraduate students: our graduate students.

RATIONALE Every year, graduate students in the Department of Earth and Ocean Sciences (EOS) contribute to the delivery of more than 50 undergraduate courses, interacting with more than 2000 students. The department employs approximately 60 Teaching Assistants (TAs) per year, at an average rate of 6 hours per week per TA. EOS TAs contribute to the education of our undergraduates in many ways: they run laboratory sessions, lead in-class tutorials and mini-lectures, support students one-on-one at our help centre, lead field trips, and mark assignments and exams. Until 2007, our department had no formal system to train and support TAs; experience was gained on the ground with the support (or lack of support) of the course Instructor and fellow TAs. The obvious limitations of "training by practice" was compounded by a relatively high turnover rate; each year, approximately 30 new TAs start teaching in the department. Recognizing the important role TAs play in the education of undergraduates and the opportunity for professional development for graduate students, the Earth and Ocean Sciences department began a graduate course in 2007, entitled Teaching and Learning in the Earth and Ocean Sciences (EOSC 516). EOSC 516 is based on the Instructional Skills Workshop¹ model, which is an instructor development program offered by many universities across Canada and abroad.

LEARNING GOALS By the end of the course, students will be able to:

- Effectively evaluate peers and provide constructive feedback
- Create an environment conducive to learning for diverse groups of students
- Develop strategies for fostering student inquiry and independent learning in Earth and Ocean Sciences while meeting students' need for support
- Formulate learning objectives for TA-led activities in Earth and Ocean Science courses
- Engage in critical reflection on one's own teaching practice
- Design and implement mini-lessons and lab assignments for Earth and Ocean Science courses using the frameworks provided in the course

THE EVOLUTION OF EOSC 516 EOSC 516 has gone through several iterations since it was first envisioned. Initial development of the course was led by a committee of current and recently completed graduate students. Subsequent changes have been based on course feedback and recommendations of the Instructor and Head TAs.

2007

- Changed from a two-day workshop offered at the end of August to biweekly meetings

2008

- Course assigned a 2-credit weighting
- Added a lab redesign activity
- Began using Pre/Post Teaching Attitudes survey for assessment

2009

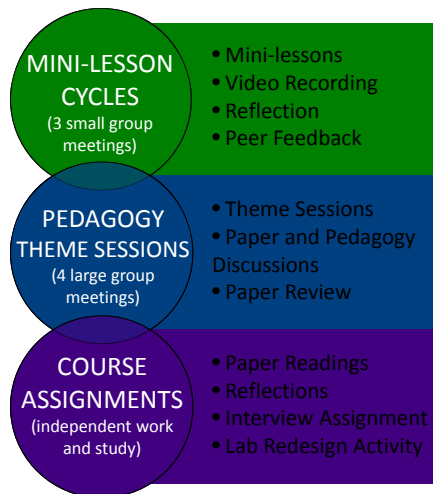
- Improved documentation of workshop material (handouts, presentations, etc.)
- Changed from a graded course to a Pass/Fail course

Proposed Changes for 2010

- Reduce the workload of the lab redesign activity and introduce a series of smaller assignments
- Facilitate a theme session about extra credit options with CWSEI and other teaching resources

What part(s) of the course did you find most useful? Why? **"I have trouble with presentations but I think the mini-lessons helped me in building my self confidence and being effective at choosing material"**

COURSE STRUCTURE



"Honestly, I enjoyed it a lot more than I thought I would. I feel that I gained something useful, I think I will be a better teacher for it"

COURSE STRUCTURE

Course meetings occur every 2 weeks, alternating between large group (all enrolled students) and small group (4-5 students) sessions. A total of 7 meetings occur throughout the semester.

Pedagogy Theme Sessions (large group sessions)

Large group sessions are designed to encourage class participation in pedagogical and literature discussions, and to engage students in a variety of activities. Theme sessions are designed to follow teaching models presented in the course, which students are encouraged to use in their lessons (see *Mini-lesson Cycles*). Both the course Instructor and Head TAs lead theme sessions, which allows for variety in lesson planning and teaching style, and also offers valuable teaching experience to Head TAs.

Mini-lesson Cycles (small group sessions)

The class is divided up into working groups of 4-5 students that meet three times throughout the semester. During each small group meeting, a Head TA will facilitate a mini-lesson cycle. Drawing specifically from lesson planning and learning objectives theme sessions (see *Pedagogy Theme Sessions*), each student completes a microteaching cycle, which includes: teaching a 10-minute lesson, reflecting on that lesson, and receiving verbal and written feedback from their peers. Lessons are also videotaped for later viewing and reflection (see *Course Assignments*). The main benefit of this format is that in addition to teaching and obtaining feedback, each student also observes and provides feedback on peers' mini-lessons. Throughout the semester, participants also propose teaching challenges for their peers, as risk-taking is emphasized in later meetings. Challenges are wide-ranging, they can target technological crutches, encourage students to teach a lesson in a different domain of learning, or even suggest a difficult topic.

Course Assignments

The course contains a variety of assignments. Prior to each large group meeting, students read an assigned paper in preparation for class discussion. After each small group session they reflect on recordings of their mini-lessons. During *Pedagogy Theme Sessions*, students small group have the opportunity to share their ideas and comments based on their reading and reflection. Students also complete one larger assignment during the semester; they have the option of conducting an interview of a novice or redesigning one of the labs offered within EOS.

REFERENCES ¹For more information about the Instructional Skills workshop visit: <http://iswnetwork.ca/>

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Would you recommend this course to other graduate students in EOS? Why or why not? **"Hell yes. Great way to learn effective teaching methods in EOS if you don't have the time to take an Education Degree"**

COURSE EVALUATION

Pre/Post Teaching Attitudes Survey

Starting in Fall 2008, we began to use a Teaching Attitudes Survey (based on one developed in the Department of Physics and Astronomy at UBC). The survey presents a series of statements and gauges respondent agreement to those statements using a 5-point Likert scale. Attitudes are notoriously difficult to change, especially over short time scales such as one semester.

In general, we found that students taking EOSC 516 have expert-like attitudes. For many survey statements, the majority of the class did not significantly reevaluate their opinions over the course of the term (for example Figure 1).

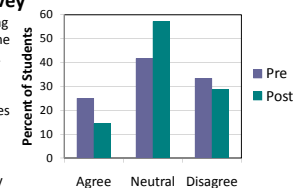


Figure 1: Pre/Post Teaching Attitudes survey answers for "Doing lots of quantitative textbook problems is an effective way to develop scientific knowledge" in 2009

On questions gauging teaching confidence, however, students are much more confident by the end of the course (Figure 2).

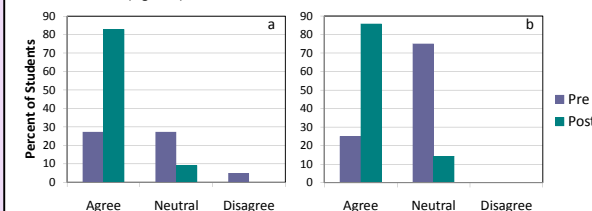


Figure 2: Pre/Post Teaching Attitudes survey answers for "I consider myself to be an effective teacher" in a) 2008 and b) 2009. Total number of respondents in 2008 and 2009 were 12 and 14, respectively.

Summative Evaluation Forms completed at the end of the semester probed for student opinions on various aspects of the course. Summaries of key questions are below:

Questions 1 & 12: What aspects of the course were most/least effective? The opportunity to teach mini-lessons and receive feedback from peers was the most effective aspect of the course for many students. The most effective theme sessions included learning styles, learning objectives, and the BOPPPS model. As opposed to widespread agreement over the most effective aspects of the course, the least effective theme sessions of the course were quite varied. These least effective sessions include group dynamics, marking and rubrics, and cooperative learning.

Question 2: If you could change one part of the course, what would it be? Recommendations included meeting more frequently, either to eliminate long class periods or to discuss theme session topics in more depth (thereby increasing the course credit weight). Other suggestions included increasing the amount of mini-lessons taught per student, and offering a 2nd-part course in the winter term of the school year in which to discuss pedagogy topics in more depth. Suggested changes to EOSC 516 have also requested opportunities for further learning; some students suggested theme sessions we could include in future semesters (learning disabilities, effective testing techniques) or wished to apply knowledge learned from theme sessions to an assignment (Socratic method).

Question 11: What would you like to see as a follow up to the course? Students requested a teaching seminar series, workshops, teaching books and manuals, or regular emails with teaching tips as a desired follow-up to the course. A few students wished for us to facilitate feedback from students in the EOSC classes they TA, or to facilitate conversations with EOS professors about pedagogy topics.

In the three years the course has been offered, all participants that filled out the summative evaluation forms say they will recommend EOSC 516 to other students.