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Teaching Dossier  
Evidence of Teaching Excellence, Impact, and Growth

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## 1. Personal Information

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My dissertation is a combination of Geological Sciences research and Geoscience Education research, specifically the creation of a statistically-validated concept inventory for introductory mineralogy courses. This concept inventory can be implemented in any introductory mineralogy course to assess prior knowledge and learning gains. This will be the first time that anyone in the Department of Earth, Ocean, and Atmospheric Sciences (EOAS) has incorporated education research into a graduate thesis, and one of only a few in all of UBC (outside the Faculty of Education). I am pursuing this because I believe that discipline-specific research and teaching are intimately linked, and the transfer of knowledge and inspiration of the next generation depends on being well-versed in both. I want to increase the relevancy of geoscience education research within my department, in hopes of inspiring instructors and professors to rethink some of their approaches to teaching in the geosciences.

- B.Sc. Honours (2014) Geological Sciences, Queen's University

## 2. Teaching Philosophy

My teaching focuses on my students and their needs. I employ a learner-centered approach and acknowledge that the student's enjoyment of the course is an important part of their experience. I utilize and develop teaching techniques that ensure my students are participating throughout the class, engaging with the material, and ultimately enjoying the lesson. I believe that how a teacher interacts with their students and the classroom environment that they promote plays a large part in learner success. A positive classroom environment can motivate a student to ask questions, participate in class discussions, and provide constructive feedback, all of which promote learning.

I make a point of learning as many my students' names as possible. I want them to feel comfortable interacting with me and know that I care about their learning. As much as possible, I ensure that I make myself available both inside and outside of the classroom. I want students to feel comfortable discussing the course and anything else that may be affecting their participation and learning. It is important to recognize that people have lives outside of class and that these can affect even the most dedicated of students. I try to be understanding and empathetic, and I accommodate students when possible and appropriate.

I use active learning techniques in all classes I teach to keep students more engaged. I limit the amount of lecture time, and whenever I do lecture, I integrate a variety of techniques such as

think-pair-share exercises, iClicker questions, and other questioning techniques. I add discussion to iClicker questions by asking students to explain to their neighbour why their answer is correct. This promotes discussion and encourages them to think critically about their answers.

I want students that I teach to leave my class feeling inspired, motivated, and assured that if they put in effort, they can learn and succeed. I strive for the “ah ha” moment, in which I know that a student understands the concept and will be able to apply it in the future. I love the challenge of determining which instructional approach will work best for a specific student, and I am always willing to put in the extra effort to help them learn.

I care about what my students think. I frequently request feedback on my classes by administering my own in-class feedback forms. I also conduct online surveys about new course activities, or just to check-in during the semester to see how the course is going. I value the feedback provided in my TA evaluations and actively work to improve my teaching based on that feedback.

I constantly strive to improve my teaching by observing classes taught by instructors I look up to and inviting them to attend my classes, after which I solicit their feedback. I frequently participate in teaching development programs and look for other new experiences, such as giving guest lectures in classes outside of my discipline, all of which will improve my teaching

Outside of the traditional classroom, I facilitate graduate Instructional Skills Workshops (ISW). In this role I take a facilitative approach to teaching, guiding students as they generate content, provide feedback to their peers, and build their own teaching skills. My experience as a facilitator has influenced the way I teach, most notably by prompting me to reflect on my own teaching practices and to consider their impact on the learning experience of my students.

Teaching is something I am truly passionate about. By fostering a positive, learner-centred classroom environment, I can motivate my learners and ensure that the learning experience is rewarding for all.

### 3. Teaching Awards

1. **April 2018:** *Killam Graduate Teaching Assistant Award* – This award recognizes the valuable role that TAs play in undergraduate programs at UBC. It is awarded each year to a small number of TAs who have made outstanding contributions to teaching and learning.
2. **December 2013:** *Endeavour Silver TA Award* – I received this award during my undergraduate degree at Queen’s University for my work as a TA in GEOL 232 – Mineralogy. I was nominated by my students.

## 4. Teaching Responsibilities

### 4.1 Courses Taught

*EOSC 118 Distance Education – Earth’s Treasures: Gold and Gems: September 2017 – Present*  
Since the Fall 2017 term, I have been the instructor for the distance education course EOSC 118: Earth’s Treasures: Gold and Gems. I have been offered and accepted the position for Summer 2018. In the Fall 2017 term 250 students were enrolled in the course, and in the Winter 2018 term enrolment increased to 314 students.

Before I started teaching EOSC 118, I was a TA for the course for three terms (Section 3.2). During my time as a TA, I became extremely familiar with the course content, activities, and assessments, and with how students interact and engage in an online learning environment. I noticed that several of the assignments were not designed to promote comprehension and learning of material, but rather focused on memorizing facts and terminology. Furthermore, the course schedule was not as structured as it could have been, since all the lessons were released at the same time. Some students are capable of being self-motivated and progressing through the course on their own, but I felt that more structure should be provided to ensure that new content was introduced at a manageable pace.

When I was asked to teach the course, I started making manageable changes to the activities, assignments, and grade distribution in an effort to improve student learning. The changes I have implemented include creating new Learning Objective Activities (Section 4.2), changing the format of the quizzes to be more concept-focused and aligned with the course learning objectives, and creating short Check Your Understanding question sets at the end of each lesson. I also revised the mark distribution to de-emphasize the final exam. I believe that it is important for students to be assessed using a variety of methods. Some students find final examinations extremely stressful and do not perform to the best of their abilities, while others struggle with writing assignments even though they comprehend the material. By adding more assessments and placing less weight on the final exam, students can more accurately be assessed.

*Symmetry – Vancouver Summer Program (VSP): July-August 2017*

I was a co-instructor for Symmetry, a course offered through the VSP, in the summer of 2017. The VSP is a four-week intensive academic program during which students from universities abroad study at UBC while learning about Canadian practices and culture. 48 students were enrolled in the course. Together with my co-instructor, I prepared and taught 14 interactive classes (3 hours each, spread over 4 weeks) consisting of pair and small group work, and activities.

### 4.2 Teaching Assistant

As a TA in the Department of EOAS and for the Integrated Sciences program I have been involved in 10 unique courses, working with nearly 1,700 students. After my first year as a TA at UBC, I was no longer randomly assigned to TA a course, but instead was specifically requested

by instructors to TA their courses. I have always received strong teaching evaluations, with an average rating in all categories of 4.7 out of 5 (Section 6.1).

During several of my TA positions, I taught classes either at the request of the regular instructor or as part of the Certificate in Advanced Teaching and Learning (CATL) program (Section 5.2) that I completed at UBC. The instructors that I worked for would frequently ask me for my opinion on course assignments and teaching practices. I was often asked to help design new course activities, which is not normally a task that is done by a TA.

*EOSC 516 – Teaching and Learning in Earth, Ocean and Atmospheric Sciences: September-December 2017; 2016*

This graduate-level course in teaching and learning is modeled off of the ISW. The course had 10 students in 2017 and 13 students in 2016. This six-week course alternates each week between 2-hour-long pedagogical sessions involving the entire class one week and 4-hour-long small group sessions the next week. During pedagogical sessions I facilitated lessons on topics such as learning objectives, facilitating discussions, and teaching resources. The small group sessions involve students teaching their own short lessons on a topic of their choice. I facilitated cycles of lessons, self-reflection, and group feedback. I also spent 1-2 hours per week meeting with the course instructor and other TA, and preparing for the lessons.

*EOSC 118 Distance Education – Earth’s Treasures: Gold and Gems: September 2016-August 2017 (3 consecutive semesters)*

This is a large online course with enrolment of 127 students in Summer 2017, 249 students in Winter 2017, and 295 students in Fall 2016. I spent 3-4 hours per week interacting with students through a discussion board hosted on an online learning platform. Students would post questions about the course content and assignments, and I led them towards the solution by asking guiding questions and suggesting additional material that could help them discover the answer on their own. In the Summer 2017 semester, I re-designed several of the course assignments. In the Winter 2017 semester, I wrote the majority of the questions used on the final exam. The questions I wrote required students to apply and synthesize concepts and replaced many previous exam questions that only required the memorization of facts and terms.

*ISCI 360 – Systems Approaches to Regional Sustainability: January-April 2017; 2016; 2015*

This course consists of talks delivered by guest lecturers from various departments at UBC. Enrolment was 45 students in 2017, 54 in 2016, and 40 in 2015. I attended one 2-hour class per week in which I was able to directly interact with most students in the course, engaging in discussions with them on various topics in sustainability. I also met with the course instructor for one hour per week to complete tasks such as designing new assignments and writing the midterm and final exam. During the Winter 2017 semester, I taught a class on systems thinking consisting of several in-class activities and discussions. In 2016, I proposed and created pre-class assignments to ensure that students came to class with the necessary background knowledge.

These assignments are still being used in the course today. Some of my other duties included maintaining the course website and corresponding with the guest speakers.

*ISCI 330A – Topic in Integrated Sciences: Symmetry: September-December 2016; 2015; 2014*

This course explores all aspects of symmetry as it relates a variety of fields in science. It is a relatively small class with 40 students in 2016, 39 in 2015, and 41 in 2014. Learning symmetry involves hands-on manipulation of 3-dimensional objects and 2-dimensional patterns. As such, the class frequently involves in-class activities, allowing me to interact extensively with students through small group and one-on-one discussions. I attended two 1.5-hour classes per week, frequently staying after class to help students work through problems and answer questions. I made myself available to students outside of class by offering in-person meetings, meeting students in the classroom when requested for help sessions, and answering their questions via email. This and my other duties for the course (described below) totalled approximately 3 hours per week.

Throughout my years as a TA for this course, I taught a total of five classes, either at the request of the instructor or as part of the CATL program (Section 5.2). I was involved extensively in course development. The instructor valued my perspective and would frequently consult with me about his lesson plans, activities, and assignments. I created an in-class activity in which students work in pairs and then small groups to determine the relationship between 2- and 3-dimensional objects. I also developed a flow-chart activity in which students discover how the symmetries of different 3-dimensional objects are related to one another.

Following the flow-chart activity, I conducted an anonymous, online survey to gauge if the activity helped students learn the relationship between symmetries and if completing it improved their understanding of the topic. The vast majority of students that said that strongly agreed (24%) or agreed (68%) that the assignment made it easier for them to understand how point groups are related. Specific comments that students provided when asked included what the most helpful thing about the assignment were: “It helped visualize how point groups are narrowed down, and see which pathways we can follow/questions we can ask ourselves - something you won't get just by listening in class” and “I like how it made us really think about what was different between different point groups, which could help you narrow down your choices. For example, I didn't understand the difference between  $2/m\bar{3}2/m$  and  $3\bar{2}/m$  until I went through the assignment...”.

My teaching practices have had a lasting impact on the course. During one of the classes that I taught, I used the CAPER Card application for answering in-class multiple choice questions and the instructor has now incorporated this technique into his own lessons, both in ISCI 330A and in another course that he teaches. Both the 2- and 3-dimensional object in-class activity and the flow-chart activity that I developed are still used in the course.

*Symmetry – Vancouver Summer Program: July-August 2016; 2015*

This is a four-week intensive course offered through the VSP, consisting of fourteen 3-hour classes 26 students were enrolled in 2015 and 20 were enrolled in 2016. I spent 2 additional hours

per week working with the instructor to prepare for classes. During the interactive classes, I guided students through the activities as I explained concepts to them and answered their questions. Although I was hired as a TA, I prepared and co-instructed several of the classes. During the 2015 offering, I helped develop new, interactive assignments such as a museum scavenger hunt in which students looked for symmetry in mineral specimens. This activity is still used in the course and has also been adopted in ISCI 330A.

*EOSC 114 – The Catastrophic Earth: Natural Disasters: May-June 2016*

This is a large (213 students) first-year course offered in a condensed version during the summer semester. Students attended three 2-hour classes per week in which they learned about natural disasters such as volcanic eruptions, earthquakes, and tsunamis. I worked closely with the course instructor to write iClicker questions and create new in-class activities. I attended most of the classes to help administer in-class activities, clarify concepts, and guide students through the activities. I spent 11 hours per week on these tasks. I also prepared and taught a class on earthquakes at the request of the course instructor. For this class, I wrote several new iClicker questions, some of which incorporated YouTube videos and think-pair-share discussions.

*EOSC 221 – Introductory Petrology through the Carl Wieman Science Education Initiative (CWSEI): January-April 2016*

This was a unique TA position in which I worked for 6 hours per week as a teaching assistant for a Science Teaching and Learning Fellow (STLF) on course development. I was the only graduate TA hired to work on courses through the CWSEI. I worked with 88 students, five course TAs, and the course instructor. Together with the STLF, I created six pre-lab assignments that students complete before a lab to ensure that they have learned the necessary pre-requisite material to succeed in the lab (Section 4.1). I also created and implemented a survey in which students could provide feedback on these assignments. We designed four knowledge surveys that students completed at the beginning and end of each course module (Section 5.1.4). Finally, I revised the lab assignments to make them more clearly structured and wrote answer keys for all the labs.

*EOSC 323 – Structural Geology I through the CWSEI: September-December 2015*

As with EOSC 221, this TA position allowed me to work with an STLF on course development (6 hours per week). I worked with 67 students, two course TAs, the head TA, and the course instructor. The main product was five pre-lab assignments. I also helped design and run a two-stage review during the first class. In a two-stage review, students work individually and then in groups to answer questions about required pre-requisite knowledge for the course. Finally, I created midterm lab and lecture surveys in which students could provide feedback on what was working well and what needed to be improved for the remainder of the semester.

*EOSC 116 Distance Education – Mesozoic Earth: Time of the Dinosaurs: May-August 2015*

This is an introductory science distance education course in which students learn about the Earth during the Mesozoic era, notably when dinosaurs roamed the planet. 87 students were enrolled in



the course during the Summer 2015 semester. I spent 9 hours per week interacting with students and corresponding with the instructor. My main task was to interact with students via discussion boards hosted on the online learning platform. In addition to answering students' specific questions, I would post my own questions about every lesson. I used these to check that students were understanding the material and would prompt them to explain their thought process instead of just stating the answer. Students could also use these questions as examples of the types of questions that could be included on the exams.

#### *EOSC 116 – Mesozoic Earth: Time of the Dinosaurs: January-April 2015*

This is the face-to-face version of EOSC 116 Distance Education. 236 students were enrolled in the course during the Winter 2015 semester. I spent an average of 6 hours per week working with the instructors, other TAs, and students. During weekly meetings with the instructors and TAs, I made suggestions and provided feedback on course activities and assessments. I always try to think of myself in the place of the student and consider what would benefit them the most. I attended several of the hour-long classes during the semester to help administer activities and guide students towards the answers to the questions. I was also responsible for compiling and analyzing data from class activities. These activities included ice-breakers at the start of term, recall exercises, and longer activities about a key concept from the class.

### 4.3 Other Teaching Duties

#### *Graduate Facilitator – Centre for Teaching, Learning, and Technology (CTLT): May 2017-Present*

I am a graduate facilitator of ISWs and TA training workshops for graduate students at UBC. In this role I design and facilitate sessions on topics such as assessment, challenging classroom situations, active learning, and facilitating discussions. The central component of ISWs involves participants teaching short lessons. I engage participants in discussions to allow them to self-reflect on their lessons, and I facilitate group feedback sessions following the lessons.

#### *Pacific Museum of Earth (PME): January 2015-August 2016*

I was a volunteer workshop leader and tour guide at the PME. I led workshops on various topics related to Earth Sciences, such as volcanoes, rocks, minerals, and fossils. Workshop participants varied widely in age from young children to high school students to retired adults. I enjoyed adapting my teaching style to the variety of participants that I interacted with.

## 5. Materials Created for Students

### 5.1 Pre-Lab Assignment – Identifying Minerals in Thin Section

As a TA to an STLF through the CWSEI, I created pre-lab assignments for EOSC 221: Introductory Petrology. The purpose of pre-lab assignments is to prepare students for a lab by having them complete an assignment on the prerequisite material for the lab. By completing pre-

lab assignments, students ultimately learn more during the lab because they have the necessary background knowledge to more thoroughly understand the content, and the instructor does not have to review material that is not part of the lab itself.

Many of the questions on the pre-lab assignments were about identifying minerals in thin sections. Thin sections are very thin slices of rocks (~30  $\mu\text{m}$ ) that have been mounted on a glass slide so that the optical properties of minerals can be viewed under a polarizing microscope. Generally, students can only view thin sections in a lab with polarizing microscopes, but using an online virtual microscope library, students were able to manipulate and examine optical properties of minerals on their personal computers, prior to the lab.

The following are examples of questions that were included in two of the pre-lab assignments, as well as feedback provided to the students following their completion.

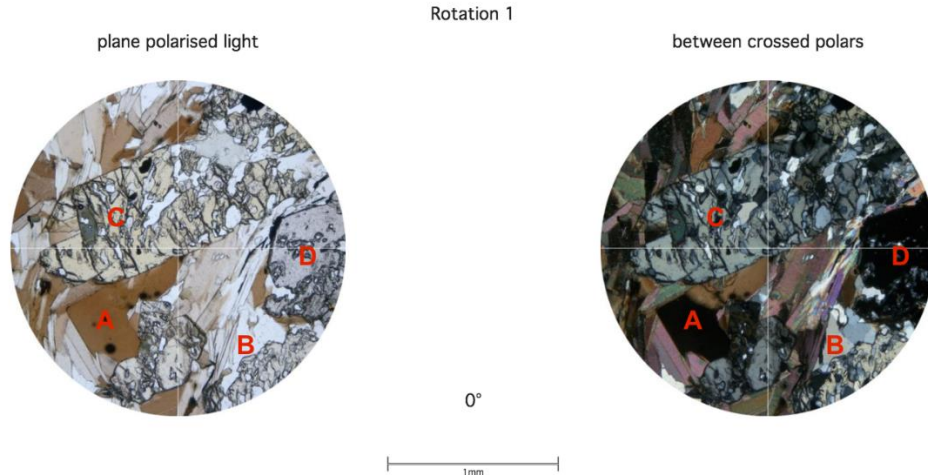
Q: Go to “The Open University Virtual Microscope”. In the drop-down menu on the left side of the page, select **gabbro**. Then go to **Gabbro: View 1** by clicking on the cross symbol near the middle of the picture of the thin section. Rotate the stage while observing both the PPL and XPL views. What property/ies can you use to determine if the pyroxene is OPX or CPX? Select all correct answers.

- A. Extinction
- B. Interference colours
- C. Cleavage
- D. Pleochroism

*Feedback provided to students after they complete the assignment:* OPX has parallel extinction while CPX has inclined extinction. OPX has lower, first-order grey to yellow interference colours while CPX has higher, second-order blue to yellow interference colours. Both minerals have cleavage and both minerals could potentially be pleochroic.

Q: Examine rotation 1 from the thin section of staurolite schist from the Virtual Microscope website and fill in the blanks in the following sentence.

In the image below, the mineral labeled A is \_\_\_\_\_, the mineral labeled B is \_\_\_\_\_, the mineral labeled C is \_\_\_\_\_, and the mineral labeled D is \_\_\_\_\_. Minerals C and D are \_\_\_\_\_ (hint: textural term).



*Feedback provided to students after they complete the assignment:* Mineral A can be identified as **biotite** because of its extreme pleochroism in plane polarized light (PPL) and also be the pleochroic halos it contains (black circles) that can be seen in both PPL and crossed polarized light (XPL). Mineral B can be identified as **quartz** because of its low relief in PPL, undulose extinction in XPL, and lack of cleavage. Mineral C can be identified as **staurolite** because of its yellow pleochroism and high relief in PPL, and its low interference colours in XPL. Also, staurolite commonly occurs as a poikiloblast. Mineral D can be identified as **garnet** because of its very high relief in PPL and because it is isotropic. Also, garnet commonly occurs as a poikiloblast. Minerals C and D are called **poikiloblasts**. They are not “poikiloblastic” because that term is used to describe the texture of the entire rock.

## 5.2 Learning Objective Activity

I created Learning Objective Activities after I was a TA for EOSC 118 for three semesters and had realized that changes needed to be made to many of the course activities and assessments to ensure that they promoted learning and understanding of the material. When I became the course instructor, I added four of these activities throughout the semester. These activities require students to write a short lesson on a learning objective from recently covered material. Rather than summarizing the course notes, they must explain the topic in their own words in a way that will help other students learn it. To do this, students often substitute lay-language for discipline-specific jargon. The activity of each student is always different because each student finds different concepts more or less difficult and feels that they require more or less explanation. These activities are posted on the course Connect page where all students are able to view and comment on them in order to try and bridge the gap in engagement and interaction that is often created in the online learning environment.

The second component of this assignment is that each student writes a concept-focused multiple choice question related to their lesson. This requires students to think about the material in terms of the concepts it contains, ideally integrating multiple concepts from one or more lessons, and move away from the memorization of facts. By writing a question about their lesson,

students must consider the material from a different perspective as they assess which aspects of the material are most important to understanding it. These questions were peer-graded using a comparative ranking system called ComPAIR, and the top-ranked questions were included on the subsequent quiz.

Following the first learning objective activity, I released a survey soliciting feedback about the activity. I wanted to know if it promoted comprehension of the material and if students felt that it was beneficial to their learning. 195 out of the 283 students that completed the activity responded to the survey. The survey made it immediately evident that some parts of the activity were doing exactly as I had intended, while others required revision. When asked if the activity helped them to better understand the material, the vast majority of respondents said that they either strongly agreed (18%) or agreed (57%) that it did. The main issue with the assignment was the use of the peer-grading platform to grade the questions. Students felt that the comments they received on their questions were not helpful, and they were frustrated that they were not able to view all of the questions, and instead could only view the small subset that they were required to assess. After reflecting on their feedback read and re-evaluating what I wanted students to get out of this activity, I decided to omit the peer-grading from the remaining activities, and instead have all the multiple choice questions posted within a separate discussion board forum. I monitor this forum and flag concept-focused questions, while prompting students to determine the answers to the questions and explain their reasoning.

Overall, the activity seems to have achieved my most important goal, which was to help students better understand the material. Some specific comments from students when asked what they found most helpful about the learning objective activity were:

- Having to reuse learned material and apply it to an assignment sooner rather than at the end of the semester on the final. It helped me to pace my learning.
- Putting together an assignment to teach other students helped me solidify the concepts for myself as well.
- Analyzing how well I knew the material and forcing me to be able to explain it in a very simplistic manner.
- Creating the MC question required me to actually understand the LO, it really helped/motivated me to study!

## 6. Commitment to Growth

I am constantly striving to improve my teaching by conducting research in teaching and learning and by participating in professional development programs. I was specifically selected for many of the projects I have been involved in due to my experience, enthusiasm, and passion for teaching that I exhibited as a TA. Through this work, I have collaborated with numerous faculty members, students, and other TAs from a variety of departments at UBC. I am extremely passionate about teaching and hope that my research will inspire instructors and professors to rethink some of their approaches to teaching in the geosciences.

## 6.1 Geoscience Education Research

### 6.1.1 Mineralogy Concept Inventory

As part of my doctoral research, I have created a statistically-validated concept inventory for use in introductory mineralogy courses. This research will be presented as part of my doctoral dissertation in Geology. I am the only graduate student to incorporate teaching research into a graduate thesis in EOAS, and one of only a few students in all of UBC (outside of the Faculty of Education). Myself and my co-supervisor designed this project due to my interest in teaching and desire to conduct research in the field.

Since 2007, an initiative to improve science education at UBC has prompted a shift towards more learner-centred pedagogies in undergraduate courses, including introductory mineralogy. I wanted to assess the impact of this shift on student learning. To do this, I created and implemented the Mineralogy Concept Inventory (MCI) as a pre- and post-assessment in two settings: (1) UBC, which uses learner-centred pedagogy, and (2) Queen's University, which has similar course content but uses more traditional, instructor-centred teaching methods.

I developed the MCI over two years through an iterative cycle of consultation with experts from both universities, think-aloud interviews with students, implementation of the assessment, and statistical analysis of the results. As much as possible, the question answers and distractors were written using student language, so that the comprehension of technical jargon would not be confused with the understanding of concepts. The items were validated using grounded theory and Rasch analysis. Rasch analysis allowed for a scaled test score to be calculated that more accurately reflects the difficulty of questions. All questions were analyzed for differential item functioning to ensure that they were not biased towards any subset of the population.

My initial results indicate that UBC had significantly higher learning gains than Queen's. Interestingly, UBC had a lower average score on the pre-assessment, likely because enrolment in the mineralogy course requires no geology pre-requisites, while students at Queen's are required to take at least one 100-level geology course. This suggests that instructional methods can overcome a lack of prior knowledge. The MCI is a validated concept inventory that can be implemented in any introductory mineralogy course to assess prior knowledge and learning gains.

### 6.1.2 Scholarship of Teaching and Learning (SoTL)

#### *The Impact of Teaching Techniques on Student Engagement: January-December 2017*

I designed and implemented a SoTL project to investigate one of my core teaching values: the classroom environment that I foster and its impact on student engagement. I conducted my research over the course of two semesters in two different Integrated Sciences courses: ISCI 360 in January 2017 and ISCI 330A in September 2017. I was a TA in ISCI 360, while in ISCI 330A I taught a class as a guest instructor.

To assess student engagement, I had several observers come to my class and complete a Behavioural Engagement Related to Instruction (BERI) evaluation. The observers noted how

many students out of the subset they were observing were off-task, or not paying attention, at two minute intervals throughout the lesson. I also asked students to complete an anonymous survey at the end of class that asked questions that prompted them to think about how engaged they were during the class.

Based on the BERI evaluation I found that students in both courses were most engaged while they were working on an in-class activity, answering iClicker questions, or discussing course material with their peers. Students were least engaged during lecture, when one other student was answering a question, and when any one technique was used for an extended period of time. Engagement generally decreased from the start to the end of the class. Interestingly, the overall percentage of students engaged was significantly lower in ISCI 330A than ISCI 360, even though the class I taught in ISCI 330A was arguably more engaging and interactive. I believe this indicates that student familiarity with an instructor plays a large role how engaged they are during a lesson. The results of the survey supported that the use of in-class activities and worksheets, and discussions engaged students.

The results of this study will influence my future teaching practices. I now have evidence specific to my own teaching that shows that students are more engaged when I use in-class activities and worksheets, and structured discussions. Undoubtedly there are other factors that influence student engagement that have nothing to do with teaching techniques, but regardless these results reflect the importance of being mindful about the teaching techniques used and their impact on student engagement. Lecture is arguably a necessary tool when teaching a class, but it must be used sparingly and to ensure that students remain engaged, giving them the best chance of actively participating in the class and learning. It is also important to use a variety of teaching techniques, and to break up large periods of lecture with questioning and short discussions. Not only does this maintain student engagement, it makes a class more exciting to teach!

### 6.1.3 Workshop Facilitation

*Well-Prepared Students: Motivating Students Before and During Class: Science Education Open House 2016*

I collaborated with STLFs from my home department (EOAS) and the Department of Physics to create and facilitate a workshop on student motivation. This workshop was one of only two that were selected to be offered at the open house. The goals of the workshop were to: (1) identify factors that increase or decrease motivation, (2) articulate a framework for understanding motivational factors and identify instructional strategies to support those factors, and (3) design an activity to add more flexibility into a class that incorporates motivational factors. My specific role in the workshop involved demonstrating the pre-lab assignments that I created as a TA for the CWSEI in EOSC 323 and EOSC 221.

### 6.1.4 Poster Presentations

*Development of a Knowledge Survey for an Introductory Petrology Course: Science Education Open House 2017*

This poster presented an analysis of the results of knowledge surveys that I created and implemented as a TA for the CWSEI in EOSC 221. Knowledge surveys require students to self-assess how well they could answer a question in an exam-like situation. Since they are completed at both the beginning and end of each module, they can be used to measure learning gains.

We matched the concepts on the knowledge surveys to concepts on the midterms and final exam to investigate if students' ability to self-assess improved through the semester. The results of this project indicated that in general, students in the top 50% of the class tended to under-assess their knowledge, while students in the bottom 50% tended to over-assess their knowledge. We did not see a correlation between students' performance on exams and their ability to accurately assess their own knowledge. Interestingly, self-assessment skills seemed to increase throughout the semester.

*Benefits and Challenges of Pre-Lab Assignments: Science Education Open House 2016*

This poster presented the work that I completed as a TA for the CWSEI in EOSC 323 and EOSC 221. We presented the benefits and potential challenges associated with creating pre-lab assignments and demonstrated how to effectively create them. Through a survey of students' opinions, we found that students thought completing the pre-lab assignments ensured they were prepared for the lab and that they learned more in the lab because they have completed a pre-lab assignment. They also stated that they planned to use their pre-lab assignments to help them study for the final exam.

6.1.5 Teaching and Learning Grants

*Funded grants*

<b>Granting Agency</b>	<b>Subject</b>	<b>Competitive?</b>	<b>\$ per year</b>	<b>Year</b>	<b>Principal Investigator</b>	<b>Co-investigator</b>
UBC – Skylight Development Grants	Assessing the Development of 3-D Spatial Visualization Skills of Undergraduate Students	Yes	\$1,323 + matching	2017	Sarah Sherman	Emily Scribner
UBC – Skylight Development Grants	Assessing Learning Gains and Students' Self-Confidence with Knowledge Surveys	Yes	\$1,323 + matching	2016	Sarah Sherman	Emily Scribner
UBC – Skylight Development Grants	Concept Inventory for Measuring Learning Gains in Undergraduate Mineralogy Courses	Yes	\$1,797 + matching	2016	Sara Harris	Emily Scribner, Lee Groat, James Scoates, and Matthijs Smit

## Unfunded grants

<b>Granting Agency</b>	<b>Subject</b>	<b>Competitive?</b>	<b>\$ per year</b>	<b>Year</b>	<b>Principal Investigator</b>	<b>Co-investigator</b>
UBC – Teaching and Learning Enhancement Fund	Concept Inventory for Measuring Learning Gains in Undergraduate Mineralogy Courses	Yes	\$24,431	2015	Sara Harris	Emily Scribner, Lee Groat, James Scoates, and Matthijs Smit

## 6.2 Professional Development

### *Certificate Program in Advanced Teaching and Learning (CATL): September 2016 - December 2017*

This teaching development program is geared towards graduate students that seek excellence in teaching and learning. Admission into the program is highly competitive and only 12-18 participants are accepted per year. It consists of ~51 hours of in-class time plus online work on topics such as experiential learning, disciplinary identity, signature pedagogies, and far transfer. Through this program I worked with 3 teaching mentors, all with unique teaching styles and skill sets. I taught 6 one-hour practicum lessons that were all observed by at least one of my mentors, and observed 6 one-hour lessons taught by my mentors. Following these lessons, we engaged in discussions about my teaching practices that I used to improve my subsequent lessons.

### *Facilitator Development Workshop (FDW): January 2017*

This is an internationally recognized 5-day training workshop that prepares experienced instructors to facilitate the ISW. Participants learn techniques for facilitating group development and formative evaluation techniques and have the opportunity to refine their teaching techniques.

### *Instructional Skills Workshop (ISW): July 2016*

This is an internationally recognized, 3-day instructor development program that enhances instructional skills. I participated in sessions on teaching practice and theory application, and applied the skills I learned through the teaching of 3 short lessons. I participated in lessons taught by my peers and helped provide constructive feedback on their teaching.

### *Skylight Reading Group: January 2016-Present (periodically)*

I have been invited to attend the Skylight bi-weekly reading group. The group discusses articles related to current research in science education. In November 2017, I was asked to attend the discussion on concept inventories to provide insight into the development of the Mineralogy Concept Inventory (Section 5.1.1)

### *Teaching and Learning Fellow (TLF) Development Series: September-December 2015*



This is a seminar series for TLFs run through the Science Centre for Learning and Teaching (Skylight). I was granted special permission to join the weekly meetings due to my interest in teaching and learning development opportunities. Over the course of nine 1.5-hour weekly meetings, we discussed topics such as prior knowledge, motivation, metacognition, and course climate, diversity, and inclusion. The series was structured around the book “How Learning Works” by Ambrose and colleagues (2010).

## 7. Assessment of Impact

At the end of the day, everything I do comes back to my students and my desire to ensure they have the best possible learning experience. I evaluate the impact of my teaching on student learning through solicited teaching evaluations and surveys, unsolicited comments that I receive from students, and evaluations that I request from observers of my classes.

### 7.1 Formal Teaching Evaluations

At the end of each course, students are asked to complete a TA evaluation survey. TA evaluation surveys in the Department of EOAS are administered online, whereas in the Integrated Sciences program they are administered in class, when the TAs are not present. The full surveys are not included here. The scores are all based on the same 5 point scale. The questions are as follows:

- A The TA was well prepared
- B The TA was helpful
- C The TA was considerate of students
- D The TA was easily understood
- E The TA was an effective instructor

Course	Term	A	B	C	D	E	Response Rate
EOSC 118 DE	May-Aug 2017	4.8	4.7	4.7	4.8	4.7	39/127
	Jan-Apr 2017	4.4	4.4	4.4	4.3	4.2	126/313
ISCI 360	Jan-Apr 2017	4.6	4.3	4.5	4.7	4.4	23/45
	Jan-Apr 2016	4.6	4.6	4.5	4.5	4.5	44/54
ISCI 330A	Sept-Dec 2016	4.9	4.9	4.9	4.8	4.9	32/40
	Sept-Dec 2015	5.0	5.0	4.9	5.0	5.0	25/39
	Sept-Dec 2014	4.9	4.9	4.9	4.9	4.9	39/41
EOSC 116 DE	May-Aug 2015	4.5	4.5	4.6	4.6	4.4	44/88
EOSC 116	Jan-Apr 2015	4.6	4.5	4.6	4.7	4.6	15/173
<b>Averages</b>		<b>4.7</b>	<b>4.6</b>	<b>4.7</b>	<b>4.7</b>	<b>4.6</b>	

*EOSC 118 DE: May-August 2017 (17 of 39 left comments)*

- Had her in EOSC114 last summer with Professor [name]. Awesome TA. Always willing and able to answer students' questions on the spot.
- Emily gave detailed explanations for questions on the discuss boards, which always allowed for easier understanding. I hope Emily keeps this up!
- Emily did a really good with helping out the students out! Just like the others she was easy to approach and got back to students with a reasonable time.

*EOSC 118 DE: January-April 2017 (54 of 126 left comments)*

- I also interacted with Ms. Scribner throughout this course, and she was a T.A. in a previous class I took and like that class she was also extremely helpful and considerate. She answered questions in a timely manner with clear explanations and always made herself open to continue elaborating if there was some confusion I faced understanding the question.
- Emily answered my questions with heart! I love reading her answers as she did her research on her own and came up with some helpful and interesting link that really helped my understanding! Thank you!
- Emily was always quick to respond on the discussion boards and the comments are easy to understand. Thanks for clarifying any questions we had! No suggestions on things to improve on.

*ISCI 360: January-April 2017 (17 of 45 left comments)*

- Emily is an effective instructor/TA, she came to the guest lecture prepared and showed students tremendous interest in the topic, also the enthusiasm in teaching. One thing I noticed is that she cares about every students in this class, regardless of the degree of contribution. Would love her to give another lecture anytime!
- Emily was a really TA who was willing to always answer questions regarding both exam/course-related material as well as administrative issues. She always had a positive attitude and made the classroom atmosphere better
- Never minded staying after class to chat about course material and always replied to emails promptly.

*ISCI 360: January April 2016 (22 of 44 left comments)*

- She shows genuine consideration towards students learning, and sends us emails to remind us about important dates.
- Emily is a very effective TA. She emailed me the explanation of one of the midterm exam question when we don't have time discuss it after class.
- I thought she was very clear with answering questions and was always available outside of class time. TA was great!

- - gave clear instructions and feedback throughout the term; - consistently available via email for extra help/clarification

*ISCI 330A: September-December 2016 (26 of 32 left comments)*

- Emily is a very effective instructor. The classes that she taught were easily understood. At times, she was more clear as an instructor than [instructor name]. She did great to serve as an intermediate communication link between the prof and the students.
- Nothing, she has been one of the best TA's I've had! She responds to emails very quickly and thoroughly and is always willing to find a time to meet if need be. Instead of just telling you yes or no, she actually helps guide you to the right answer.
- Emily was attentive and made time for office hours. She is so clear and I think she would make a wonderful prof. Maybe just be more confident when teaching – you're doing a good job!
- She's always patient with students' questions and always very helpful. She was my TA last year as well and she is definitely one of the best TAs I have had at UBC.
- Emily is extremely passionate in her area of study and challenges students to learn actively. She is great in guiding students through their own thought process and is always available to help students out.
- Emily is knowledgeable and is prepared coming into every class. It's great that she always has a positive attitude. She's relatable and approachable.

*ISCI 330A: September-December 2015 (21 of 25 left comments)*

- Full of positive energy & enthusiasm, Emily brought a fresh classroom experience that I can only describe as effective. Her quirky yet passionate personality made ISCI 330 more engaging & I wish more TAs could follow her footsteps & realize that we're humans too 😊
- Emily is an amazing TA who is so incredibly helpful, patient and understanding. She is by far the top TA I have had the pleasure of having at UBC 😊
- I enjoy how fast you reply to emails and how enthusiastic you feel about this course and rocks. Good qualities in TA! I also like how you actively listen and ask questions in [instructor name]'s lecture when we are not.
- - Very easy to communicate with, super chill, answers emails very quickly; - To switch it up in the future, Emily can try teaching a class or two?
- Emily was very organized & thoughtful of her students. She was always available to answer questions after class + very quick to respond to emails – ie. she is always considerate of her students

*ISCI 330A: September-December 2014 (21 of 39 left comments)*

- Such a helpful, kind & nice TA! <3 her! Probably one of the most awesome TA in UBC!

- Emily is a very helpful & engaging TA. Knows the course material really well, and explains it effectively with patience.
- Very helpful. Always enthusiastic & ready to answer questions. We were extremely lucky to have her as a TA.

## 7.2 Additional Feedback from Students

The following are examples of unsolicited messages (email and written) that I have received from students in classes that I have been a TA for. Since these messages were not originally intended to be used in this manner, I have not included the names of the students.

- *Email from student April 2017 (ISCI 360):*  
“Hi Emily, I just wanted to thank you for all of your work as a TA. You're by far the hardest working TA that I've had throughout my undergrad. Hopefully you have a nice and relaxing summer to make up for it.”
- *Letter from student December 2016 (ISCI 330A):*  
“Dear Emily, Thank you for your constant support and help throughout ISCI 330A. I know that you are going to be an amazing prof and I really appreciate all the hours you put into ensuring I understand the material.”
- *Email from student January 2016 (ISCI 330A):*  
“Hey Emily! Thought of you yesterday in ISCI class--I'm back for round 2 with [instructor name]! I WISH you were my TA once again--it would be a dream! Thank you for being such an exceptional TA! No one can top your level of commitment, help, kindness...and patience!!! I hope you've started term 2 on a relaxing and fun note! Wishing you nothing but the absolute best for all your future endeavours!!!”
- *Email from student April 2015 (ISCI 360):*  
“Hey Emily, Just wanted to say thank you for being a wonderful TA this term! Thank you for your help, patience, and kindness :) I wish you nothing but the best!”

## 7.3 Results of Classroom Observations

I have taught individual classes in several courses, some upon the request of the regular instructor, and others as part of the practicum component of the CATL program (Section 5.2). When I teach a class, I almost always invite an instructor to observe the class and complete a formal evaluation of my teaching. The following are results of evaluations of some of the classes I have taught.

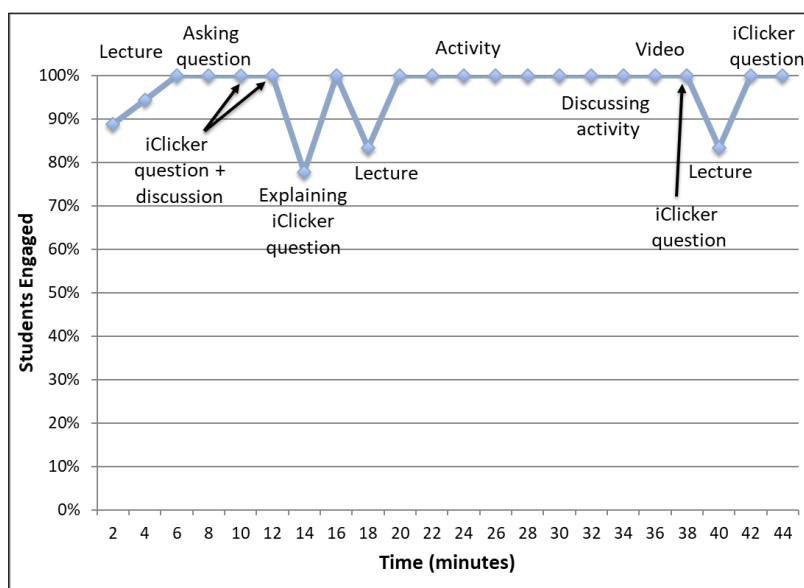
### *EOSC 110 – Behavioural Engagement Related to Instruction (BERI)*

In February 2017, I taught a class on geologic time in EOSC 110: The Solid Earth: A Dynamic Planet, offered through Vantage College for the practicum component of the CATL program. I was not a TA for this course, but the instructor was one of my mentors. This is a small course

with only 18 students in attendance for my class, so it allows for one-on-one or small group discussion between and with students.

Instead of delivering the content using only lecture with some iClicker questions and paired discussion, as is normally done in this class, I replaced 10 minutes of the lecture content with an activity in which students put geologic events in order. My motivation to create an activity was to increase the amount of interaction and engagement in the class, and allow them to discover the answers by discussing the concepts with their peers. The I activity I created is still used in the class today.

My CATL mentor observed the class and completed a BERI evaluation. These evaluations collect information related to student engagement in class. In the graph below, it can be clearly seen that during lecture the number of students that are engaged in the material drops over time (Fig. 1). By shifting class time from lecture to activity, I was able to increase the engagement in the class and allow the students to directly participate during a larger portion of class time.



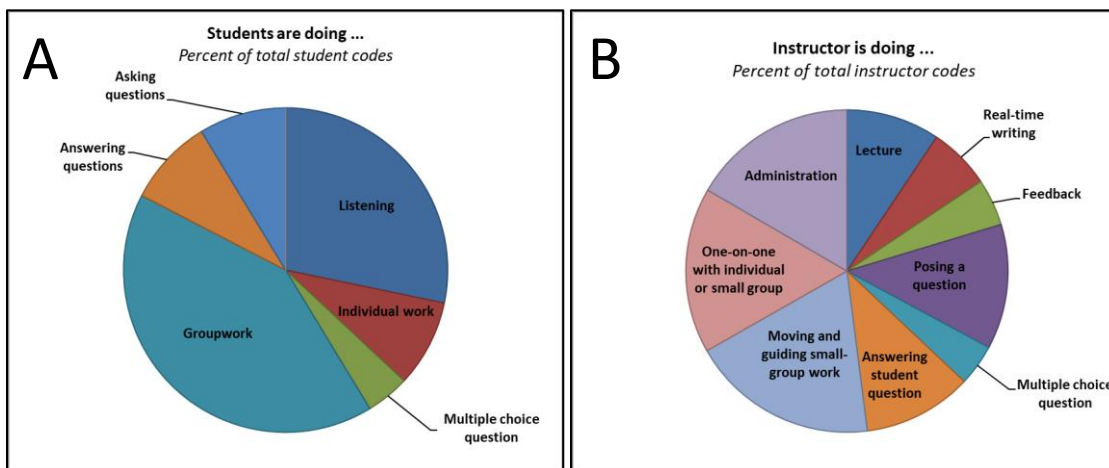
**Figure 1:** Graph showing student engagement during a lesson in EOSC 110. The labels indicate what activity was occurring in the class at any given time.

*ISCI 330A – Classroom Observation Protocol for Undergraduate STEM (COPUS)*

I taught an ISCI 330A class about symmetry elements of 2- and 3-dimensional objects to ~40 students in October 2016. I designed a new activity specifically for this class, as I felt that the current way the topic was taught needed to be revised to include more student participation.

Since this course does not use iClickers, I asked students to download the free CAPER Card application on their cell phones. This application allows students to answer multiple choice questions in class by displaying their chosen option on their screen. By asking students to hold their devices close to themselves when voting, the voting can still remain anonymous.

The STLF that observed the class completed a COPUS evaluation. These evaluations collect information on the range and frequency of teaching practices used in lesson. The results of the COPUS evaluation are shown below (Figure 2).



**Figure 2:** Results of my COPUS evaluation in ISCI 330A showing: (A) what students are doing throughout the lesson; (B) what I am doing throughout the lesson.

## 8. Contributions Outside the Classroom

### *Academic Assistant – Assessing the Development of 3-D Spatial Visualization Skills of Undergraduate Students: January 2018 – Present*

I am currently working with a Science Education Specialist (SES) to determine if, and to what extent, students' 3-D spatial visualization skills are improved at various points during their undergraduate degree. To assess learning gains in individual courses, we have administered pre- and post-assessments in three different 200- and 300-level courses. The data we collect will be used to target courses with lower learning gains and work to improve learning gains by creating activities that explicitly target these skills.

### *Academic Assistant – Assessing Learning Gains and Students' Self-Confidence with Knowledge Surveys: January-May 2017*

I worked as an academic assistant to an STLF to further analyze the results of the four knowledge surveys that we administered in EOSC 221 during the Winter 2016 semester. We received a Skylight Development grant to complete this work (Section 5.1.5). The results of this project can be found in Section 5.1.4.

### *Academic Assistant – Dinosaur Course Proposal: July-August 2015*

I worked as an academic assistant to write a course proposal for a new, 100-level course on dinosaurs. One of the major products of this work was the creation of six course activities with associated learning goals, one of which was a capstone activity in which students design their own dinosaur, integrating what they have learned about dinosaurs and their Mesozoic

environment throughout the course. I also wrote course-level learning goals and a detailed course schedule outlining the six modules and 36 lessons that would be included in the course. The course has not yet been approved, but a faculty member in EOAS is actively advocating for its creation using the proposal that I prepared.

*Articulation Representative: May 2015*

In 2015, I attended the Earth Science Articulation Meeting as the representative for the Department of EOAS at UBC. This was a full-day meeting hosted at the Simon Fraser University Harbour Centre campus where representatives around the province meet to discuss how courses articulate between institutions. I was responsible for delivering the yearly report on developments in EOAS. Following the meeting, I corresponded with faculty members in EOAS to ensure they were informed about the results of the meeting.