

Development and implementation of an in-field assessment protocol for an introductory geologic field course



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Introduction and Objectives

Many undergraduate geoscience courses at UBC are being revised in order to increase student learning, with support from the Carl Wieman Science Education Initiative (CWSEI). In the introductory field geology course (EOSC 223), we designed and implemented a protocol to assess student abilities while working in the field. This new protocol adds another dimension to traditional assessment of students' final maps, cross-sections and reports.

Our objectives for the new field-based assessment (the "Saltspring Protocol") are:

1. To improve student learning of field skills and procedures
2. To better quantify field performance and aptitude
3. To increase formative feedback to students
4. To decrease student stress levels



Course Structure

EOSC 223 (3 credits) is the first field geology course taken by second-year geology and geological engineering students. The class consists of two lectures/week, a two-hour lab every other week, and two one-day weekend field mapping exercises, followed by a seven-day field school in early May. Students learn how to use field equipment, read, interpret, and make geologic maps, cross sections, and stratigraphic sections, use stereonet, and write parts of a field report.

For the field school, the 60 students in the class are split into two groups of 30, each with their own instructors and teaching assistant. Over seven days on Saltspring Island, BC, students complete five field projects (four bedrock mapping projects and one stratigraphic section measuring exercise).



Prior Field Assessment Strategy

Prior to 2009, students were assessed at field school by grading the quality of maps, cross sections, and other written work, which is the standard method in almost all field mapping courses taught in North America. Instructors assigned a subjective "field grade" to each student, and students were told up front that "the course director reserves the right to adjust marks accordingly for your field performance and attitude, either for outstanding effort or for unprofessional behaviour." This process was never quantified and in some cases there were wide variations in the field grade that different instructors assigned to the same student.

New Assessment Strategy: The Saltspring Protocol

In-field assessments were carried out in parallel with and in addition to regular instructor-student interactions in the field such as discussions of the regional geology or outcrop interpretations.

Highlights of the protocol include:

- In-field assessments counted for 30% of the field school grade.
- Students were given sample assessment questions (see figure at right) and a grading rubric on the first day of field school.
- A 2-day grace period was followed by 5 days of formal, in-field assessments.
- Instructors marked students daily on their preparedness, field techniques (e.g., measuring strike and dip), and critical thinking skills (e.g., synthesizing outcrop data, making decisions such as how to interpret geologic relationships or choose where to traverse).
- Instructors assessed student field performance on a scale from 1 (inadequate) to 5 (outstanding).

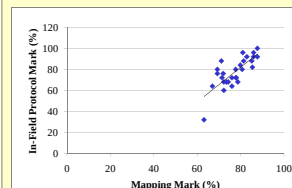
EXAMPLE ONLY 2008 Saltspring Field school - FIELD EVALUATIONS									
Rank	Student Name	Image	Degree	Subject	FIELD EVALUATIONS				
					Day 1	Day 2	Day 3	Day 4	Day 5
1	Andie, Anna		BSC	Geology	5	4	5	5	5
2	Carson, J		BSC	Geology	5	4	5	5	5
3	Chen, Crystal		BSC	Geology	5	4	5	5	5
4	Frank, Sherry		BSC	Geology	5	4	5	5	5
5	Grandy, Gary		BSC	Geology	5	4	5	5	5
6	Harper, David		BSC	Geology	5	4	5	5	5
7	Marina, J		BSC	Geology	5	4	5	5	5
8	Smith, J		BSC	Geology	5	4	5	5	5
9	Thompson, J		BSC	Geology	5	4	5	5	5
10	Wang, Wang		BSC	Geology	5	4	5	5	5

- Instructors met nightly to discuss student performances. An average mark was decided upon following a brief discussion on their interactions with each student (example in-field evaluation sheet is shown at left).
- Inter-instructor consistency was very high (e.g. daily values for each student almost always fell within one point of each other).

Results of the Saltspring Protocol

- Improvement in field abilities over the 7-day field school (figure at right) was determined via the following equation:
(Day 6 mark + Day 7 mark) - (Day 3 mark + Day 4 mark)
(Days 1 and 2 were the grace period when no marks were given.)

- The Saltspring Protocol provides objective proof that immersion in a field school setting improves student aptitude



- Strong correlation ($R^2 = 0.59$) exists between the two variables of each student's mapping mark (e.g. maps, cross-sections, notebooks, reports) with their 5-day in-field assessment mark (see figure at left)
- Results suggest that the Saltspring Protocol may be useful for early identification of students who require additional attention from the instructors and TAs

A summary of student interviews (34 in total) held in the field during implementation of the protocol:

- Students preferred group discussion assessments over being questioned individually.
- Instructors tended to answer student questions by asking additional leading questions (e.g., using the Socratic method), but students were not comfortable with this.
- Students felt that they were not given substantive feedback on their responses.
- Students with more geology background were more comfortable discussing their interpretations and maps.

SAMPLE FIELD EVALUATION QUESTIONS

Thirty (30) percent of your grade for field school will be based on your observations of you in the field, including your answers to daily questions. If we have not found you on a given day, you MUST find us. We will try hard to find everyone at least once a day, but if we don't find you, it is YOUR responsibility to let us know and find one of us. You will be "thinking out loud" or "demonstrating" your expertise to us.

Sample questions:

1. Identify this rock.
2. Name the current geologic symbol for this rock.
3. Show me what your map looks like for this.
4. Name the field procedures.
5. Name the age of a particular map.
6. Tell me where a particular unit lies in the stratigraphy of a map area.
7. Summarize (give examples) of proper preparation for mapping in mountainous terrain.
8. Explain your mapping plan.
9. Explain why it is important to know the width of a pencil line on the map scale.
10. Give your approach to mapping the area.
11. Locate this outcrop.
12. Summarize the map that a rock hammer is used in field geology.
13. Explain how to properly use a hand lens.
14. Summarize how to use a stereonet.
15. Explain how to use a hand lens.
16. Explain how to use a hand lens.
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Follow-up Student Feedback

Interviews were conducted 4 months after the field school with 11 students; 3 of the 11 were in-depth interviews lasting up to 30 minutes. Student feedback was significantly more reflective at this time, likely because students were no longer being actively evaluated.

Overall students found the new in-field assessment protocol stressful but also useful to their learning, and the following quotes illustrate the range of their responses:

- "I think it is a good idea to have the assessment; it seems like a smart idea to have some part of the grade based on how you are thinking in the field."
- "I didn't like how the [assessment questions] were worth so much; there were a few days that I wasn't questioned and I went to find a professor and I asked a question but I didn't like that."
- "[The protocol] allowed me to think more deeply into what my interpretations were and it also gave me a better sense of the field geology...and that people can have multiple interpretations."
- "I hated being put on the spot, I preferred discussions."
- "It felt like I was being marked on the accuracy of my answers."
- "[The protocol] made me work harder to know what was going on in the field. It kept me on my toes."
- "I wanted more feedback on whether or not [my answer] was correct."



Future Revisions

Student and instructor feedback indicates that we successfully addressed objectives 1 (improve student learning of field skills) and 2 (quantify student field performance and aptitude). To better meet objectives 3 (increase formative feedback) and 4 (decrease student stress), we intend to revise the Saltspring Protocol as follows:

- Better communication with students on instructor expectations prior to and during the assessments (e.g. instructors would be looking more for students' field approaches and critical thinking skills rather than for correct answers to questions).
- Increased small group discussion assessments between instructors and students.
- More substantive feedback to students immediately after a field assessment.

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