Transformation of Geological Sciences and Geological Engineering Field Methods to remote delivery using hands-on and virtual tools in fall 2020

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Queen’s University, Kingston, ON, Canada

CTL Virtual Showcase of Teaching & Learning
May 5, 2021
Introduction: GEOE/L 221

Calendar Description

“The (engineering) field study of surficial deposits, rock types, and geological processes, based on the geology of the Kingston area. Descriptions, samples and measurements acquired on several field trips will be analyzed, and the results recorded in maps, sections, and reports throughout the course.”
In Person Course Highlights

• Weekly field trips (8 weeks)
• Indoor labs (4 weeks)
• Class demonstrations
• Practical exercises
• Guest lectures
• Group term project
## Course Learning Outcomes (CLOs)

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<tr>
<th>CLO</th>
<th>Description</th>
<th>GEOE Indicator</th>
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<td>CLO-1</td>
<td><strong>Demonstrate</strong> that they can <strong>plan and conduct</strong> field investigations in a safe, ethical, socially, and environmentally responsible manner with scientific and academic integrity.</td>
<td>IN-1, PR-1, PR-2, EE-1, TW-1, IN-6</td>
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<td>CLO-2</td>
<td><strong>Demonstrate</strong> facility with basic field and lab techniques for reliable and meaningful <strong>measuring and characterizing</strong> of key geological and geological engineering parameters.</td>
<td>IN-1, KB-CEM-2, KB-TEP-3, IN-2, IN-6, PR-1, PR-2</td>
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<td>CLO-3</td>
<td><strong>Categorize and compare</strong> the rocks in an area and be able to <strong>explain</strong> the variability of the characteristics of components in a natural system.</td>
<td>IN-3, KB-CEM-2, KB-TEP-3</td>
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<td>CLO-4</td>
<td><strong>Demonstrate</strong> proficiency with <strong>basic principles of historical geology</strong> which they will be able to use to <strong>logically determine</strong> the sequence of geological events in an area.</td>
<td>KB-EOH-4, IN-3</td>
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<td>CLO-5</td>
<td><strong>Apply</strong> knowledge to <strong>solve</strong> geological and geological engineering problems with an incomplete or sparse data set in three dimensions.</td>
<td>IN-3, IN-4, IN-2, IN-1, KB-CEM-2, KB-TEP-3, KB-EOH-4</td>
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## Course Learning Outcomes (CLOs)

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<th>CLO</th>
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<tr>
<td>CLO-6</td>
<td><strong>Begin demonstrating</strong> spatial and temporal reasoning on all scales in real time during field work and during analysis of field data.</td>
<td>KB-EOH-4, IN-3, IN-4</td>
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<td>CLO-7</td>
<td>Select, <strong>analyze, synthesize, discuss</strong> (oral), and professionally <strong>report</strong> (written, visual) on geological data as presented on maps and cross-sections.</td>
<td>IN-3, IN-4, CO-1, CO-3, ET-1, PA-1</td>
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<td>CLO-8</td>
<td>In groups and individually, <strong>critically evaluate</strong> geological data and related information from a variety of sources on specific topics in field geology, and <strong>report</strong> the results in a variety of formats.</td>
<td>IN-3, IN-4, CO-1, CO-3, CO-4, TW-1, LL-2, KB-CEM-2, KB-TEP-3, KB-EOH-4</td>
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<td>CLO-9</td>
<td><strong>Collect</strong> and <strong>interpret</strong> data obtained while on the field trips, and <strong>design</strong> and submit a <strong>written report</strong> with maps and recommendations on a site-specific engineering problem.</td>
<td>IN-3, IN-4, IN-2, IN-1, DE-1, ET-1, EE-1, EC-1, IM-2, TW-1, CO-1, CO-2, PA-3</td>
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# Course Evaluation

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<tr>
<th>Assessment Tool</th>
<th>Time</th>
<th>Weight</th>
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<tr>
<td><strong>Professionalism, Individual</strong></td>
<td>Ongoing</td>
<td>5%</td>
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<tr>
<td><strong>Q&amp;A Engagement</strong></td>
<td>Ongoing</td>
<td>5%</td>
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<tr>
<td><strong>Lab Assignments</strong></td>
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<td>30% (Subtotal)</td>
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<tr>
<td>Lab 1, Individual</td>
<td>Week 1</td>
<td>5%</td>
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<tr>
<td>Lab 2, Individual</td>
<td>Week 2</td>
<td>5%</td>
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<tr>
<td>Lab 3, Individual</td>
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<td>Lab 4, Individual</td>
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<tr>
<td>Lab 5, Individual</td>
<td>Week 5</td>
<td>10%</td>
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<tr>
<td><strong>Group Project</strong></td>
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<td>30% (Subtotal)</td>
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<tr>
<td>Executive Summary, Group</td>
<td>Week 4</td>
<td>5%</td>
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<tr>
<td>Table of Contents, Group</td>
<td>Week 5</td>
<td>5%</td>
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<tr>
<td>Report, Individual Mark</td>
<td>Week 6</td>
<td>10%</td>
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<tr>
<td>Report, Group Mark</td>
<td>Week 6</td>
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<tr>
<td><strong>Exams (6 Quizzes &amp; Final Oral)</strong></td>
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<td>30% (Subtotal)</td>
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<td><strong>Total</strong></td>
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<td>100%</td>
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Course “Storyboard”
Pyramid Style

Fall A 2020
Remote Delivery

**WEEK 1: Tues. Sept. 8 – Fri Sept. 11**

**ACQUISITION**
- L1: Intro & Overview
- L2: Earth Processes
- L3: Age Relationships
- L4: Igneous
- L5: Sedimentary Pt. 1
- L6: Sedimentary Pt. 2

**PRACTICE**
- P1: Age relationships
- Q1: Practice OnQ Quiz

**DISCUSSION**
- T1: Tutorial (Zoom)
- D1: Week 1 Exit Ticket

**PRODUCTION**
- A1: Age Relationships
- Q1: OnQ Quiz

**WEEK 2: Mon. Sept. 13 – Fri. Sept. 18**

**ACQUISITION**
- L1: Metamorphic Pt 1
- L2: Metamorphic Pt 2
- L3: Structure Pt 1
- L4: Structure Pt 2
- L5: Mapping Basics
- L6: Cross-sections

**PRACTICE**
- P1: Rock ID & Description
- P2: Paper 3D Models

**DISCUSSION**
- T1: Tutorial (Zoom) + Lab Demo (Steve Beyer)
- D1: Week 2 Exit Ticket

**PRODUCTION**
- A1: Virtual Rock ID & Description
- A2: Virtual Outcrop Sketching
- Q1: OnQ Quiz

**WEEK 3: Mon. Sept. 21 – Fri. Sept. 25**

**ACQUISITION**
- L1: Compass Measurements
- L2: Field Safety
- L3: Field Navigation
- L4: Topography

**PRACTICE**
- P1: Complete the maps & cross-sections
- P2: Virtual Rock ID & Description

**DISCUSSION**
- T1: Tutorial (Zoom)
- D1: Week 3 Exit Ticket

**PRODUCTION**
- A1: Complete Map & Section
- A2: Virtual Rock ID & Description
- A3: Orienteering & Measurement Principles
  - Q1: OnQ Quiz

**WEEK 4: Mon. Sept. 28 – Fri. Oct. 2**

**ACQUISITION**
- L1: Guest – Gisele Ruderham
- L2: Guest – Tim Packulak
- L3: Stereonets
- L4: Boreholes & Drill Core
- L5: Engineering Geology

**PRACTICE**
- P1: Topography
- P2: Complete Map & Section
- P3: What’s wrong with map?
- P4: Stereonets

**DISCUSSION**
- T1: Tutorial (Zoom)
- D1: Week 4 Exit Ticket

**PRODUCTION**
- A1: Topography & Stereonets
- Q1: OnQ Quiz

**WEEK 5: Mon. Oct. 5 – Fri. Oct. 9**

**ACQUISITION**
- L1: Guest – Mark Diederichs
- L2: Guest – Callum Walter
- L3: Guest – Madison Kennedy
- L4: Surficial Geology & Soil Augering
- L5: Economic Geology

**PRACTICE**
- P1: Field trip videos 4 & 5

**DISCUSSION**
- T1: Tutorial (Zoom)
- D1: Week 5 Exit Ticket

**PRODUCTION**
- MA1: Lighthouse Bay Virtual Geology Mapping (Ind.)
- Q1: OnQ Quiz


**ACQUISITION**
- L1: Guest – Don Lougheed
- L2: Guest – Rob Harrap
- L3: Guest – Chris Spencer

**PRACTICE**
- P1: Kingston area desktop site investigation

**DISCUSSION**
- T1: Tutorial (Zoom)
- D1: Week 6 Exit Ticket

**PRODUCTION**
- Q1: OnQ Quiz

**WEEK 7: Classes Oct 19-20; Exam Oct 22-24**

**ACQUISITION**
- G1: Self & Peer Assessment

**DISCUSSION**
- T1: Exam Review & Course Wrap Up

**PRODUCTION**
- Q1: Submit Final Report & Map
- Q1: Oral Exam

Jennifer Day, CTL Virtual Showcase of Teaching and Learning at Queen’s – May 5, 2021
Skills-Based Learning Elements

MANUAL

Hands On Skills

Independent Outdoor Lab

VIRTUAL

Immersive Virtual Field Exercise

Video Demos

3D Photogrammetry Models
Field Skills Demo Videos

GEOE/L 221 Field Demo 1 Orienteering

GEOE/L 221 Field Demo Video 2 Structural Measurements
Field Trip Videos

GEOE/L 221 Field Video # 1 Hwy 15 & 401

GEOE/L221 Field Video # 2 Joyceville

GEOE/L221 Field Video # 3 Barriefield

GEOE/L 221 Field Video # 4 Sandstone Court

GEOE/L 221 Field Video # 5 Moreland Dixon Rd.
Lab Skills Videos
3D Models of Rock Hand Samples

• 3D photogrammetry models on Sketchfab database from GSGE collection & public domain

• Virtualized skill development: rock observation & classification
3D Models of Outcrops

- **Virtualized skills**: rock observation & classification
- **Manual skills**: outcrop sketching
3D Models of Outcrops

- **Virtualized skills**: rock observation & classification
- **Manual skills**: outcrop sketching

**Sketch Perspective**

**Example Sketch Submission**
Independent Outdoor Lab: Closed Loop Traverse

- Manual skills: orienteering, navigation
Manual Skills: Structural Measurements
Immersive Virtual Field Exercise

- **Virtualized skills**: field navigation, traverse planning
- **Manual skills**: notetaking, drawing maps & cross-sections

http://www.see.leeds.ac.uk/virtual-landscapes/schools/index.html
Building Community

- Introduce Yourself (Gallery Walk)
- Reading Discussions (Perusall)
- Lecture Discussions (Google Docs)
- Synchronous Labs & Tutorials (Zoom, Breakout Rooms)
- Group Project

Timeline:
- Week 1
- Week 2
- Week 3
- Week 4
- Week 5
- Week 6

Dr. Jennifer Day, PEng, PGeo (Dr. Jenn Day)

1. I grew up in Toronto, ON.
2. I completed my undergrad at Queen’s in Geological Engineering (SCI'11) and discovered Geological Engineering during APSCI'11 in first year.
3. I fell in love with the creativity involved with Geological Engineering and working with and in the natural world.
4. 5 years after completing my undergrad... I was finishing up my PhD and getting ready to move to Fredericton, NB for my first Assistant Professor position at the University of New Brunswick!
5. Most recently, I just welcomed a puppy into my home - an English Springer Spaniel named Gander (you may spot us in City Park near campus)! I also enjoy playing trumpet and like to cook and bake. My IG account is @rockdoorday - feel free to follow me!
# CLO Distribution

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Student Feedback

I learned a great deal from the lab assignments

- Strongly agree: 70% (GEOE 221), 57% (GEOL 221)
- Agree: 38% (GEOE 221), 30% (GEOL 221)
- Neutral: 5% (GEOE 221), 5% (GEOL 221)
- Disagree

I understand the connections between GS and GE

- Strongly agree: 55% (GEOE 221), 33% (GEOL 221)
- Agree: 57% (GEOE 221), 35% (GEOL 221)
- Neutral: 10% (GEOE 221), 10% (GEOL 221)
- Disagree

The practice exercises were helpful

- Strongly agree: 45% (GEOE 221), 45% (GEOL 221)
- Agree: 62% (GEOE 221), 45% (GEOL 221)
- Neutral: 14% (GEOE 221), 10% (GEOL 221)
- Disagree: 14% (GEOE 221), 5% (GEOL 221)

I like the structure of the 6 week sub-term schedule

- Strongly agree: 43% (GEOE 221), 30% (GEOL 221)
- Agree: 30% (GEOE 221), 25% (GEOL 221)
- Neutral: 29% (GEOE 221), 29% (GEOL 221)
- Disagree: 14% (GEOE 221), 14% (GEOL 221)
- Strongly disagree: 10% (GEOE 221), 10% (GEOL 221)
Conclusions

• All CLOs were achieved in remote fall 2020 offering!

• Overall student feedback was positive in the context of their first fully remote term during COVID-19

• Interactive & group work elements important for building class community

• Many resources & tools developed here will be implemented in person
Acknowledgments

• TA Gisele Rudderham, GSGE
• TA Adriana Taylor, GSGE
• Rob Harrap, GSGE
• Anne Sherman, GSGE
• Mark Diederichs, GSGE
• Dylan Layton-Matthews, GSGE
• Lauren Anstey, CTL
• Nerissa Mulligan, ETLT
• Eric Tremblay et al., ETLT
• National Association of Geoscience Teachers (NAGT)
Thank You for your kind attention!

Dr. Jennifer J. Day, PhD, PEng, PGeo

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