Challenges and opportunities in the development of a multi-institution field-based professional development program for Environmental-STEM (ESTEM) undergraduates

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Project Components and Objectives:

• Expand student awareness of environmental geoscience career options and the skills and content knowledge beneficial in preparing for these careers.

• Facilitate student development of networks in the geoscience community prior to their transition to 4YCUss and/or the workforce through engagement with stakeholders.

• Develop a system for documenting and archiving student career preparation and skills acquisition.

Summer field program,
Fall professional development seminar,
Badge Acquisition
Stages of Program Development:

**Year 1**: Stakeholder surveys, reconnaissance trip, student recruitment for cohort 1, development and alignment of course materials to badge system
*Summer 2016 – Spring 2017*

**Year 2**: Cohort 1 field course (summer) and professional development course (fall), formative and summative assessments, student recruitment for cohort 2
*Summer 2017 – Fall 2017*

**Year 3**: Cohort 2 field course (summer) and professional development course (fall), formative and summative assessments, analyze assessment data, dissemination
*Summer 2018 – Fall 2018*
Local and Regional Stakeholders
Geoscience professionals from academia, public and private agencies, and non-profit organizations that offer introductory-level employment or other work experience programs to young professionals.

General Fields:

Environmental consulting
Research
Recreation
Natural resource management
Geospatial Services

Conservation
Policy
K-16 education
Environmental engineering
Energy
Field Course for Environmental Geoscience Students: Eastern CA!

Activities and lodging at Yosemite National Park, Sierra Nevada Aquatic Research Laboratory (SNARL), and various campsites during June 9-July 5, 2017 with students from all 3 institutions (24 total)

http://www.coa.edu/shall/Geoscience/ESTEM.html
Topics Covered:

- Data Analysis
- Networking
- Ethics Training
- Proposal writing
- Data Management
- Illustrations/Figures
- Scientific communication
- Local Stakeholder Speakers
- Resume and interview practice
- Computer software (e.g. GIS, excel)

Acadia National Park personnel, COA faculty and students
Assessment

**Curriculum-focused:** Review course materials to ensure that curriculum is aligned with skills goals as identified by stakeholders.

**Student-focused:** Assess student work on field exercises, specifically to measure skills acquisition – both formative and summative (surveys, student work, and interviews with student participants)

**Program-focused:** Pre- and post-measures (interviews and surveys) of student awareness of career options, career plans, and likelihood of pursuing degree/career in the ESTEM field.

**Dissemination-focused:** Workshop and webinar evaluations to address adoptability of the program components at other institutions
Stages of Program Development:

Year 1: Stakeholder surveys, reconnaissance trip, student recruitment for cohort 1, development and alignment of course materials to badge system

Summer 2016 – Spring 2017

This Talk:
Challenges and opportunities encountered so far:
Stakeholders,
Badges,
Multi-institution planning
Stakeholder Survey results: workforce sectors of stakeholders

Other Write-Ins:
government,
National Park,
land conservation,
recycling/waste,
youth camp/education
Stakeholder survey results:
Hard skills (technical and discipline content knowledge)

Field Methods | General Science

Biological Sciences | GIS
Stakeholder survey results: Soft skills (interpersonal)

Communication

Teamwork  Listening
Field Course: Regional Stakeholders

Yosemite National Park: Geohazards planning, mapping, interpretation, resource management, restoration, park personnel panel

Southern Sierra Critical Zone Observatory: Soil survey, long-term monitoring, graduate student researchers, watershed processes, data analysis

Mammoth County Water District: Synoptic water sampling, well monitoring, infrastructure tour, field day with personnel, data analysis
Challenges and Opportunities: Stakeholders

**Challenges:** Survey technique

- Limited responses to surveys
- Stakeholders consider themselves part of multiple fields (e.g. recreation AND resource management)
- Not enough expertise in survey design

**Opportunities:** Willing to engage

- Many stakeholders responded favorably for a chance to engage with students in the field or classroom
- Expressed appreciation and encouragement for the goals of the program
- Stakeholders are actively involved in curriculum development
Badge system

Badge: symbol that recognizes skills, knowledge, accomplishments

- Student acquisition during field course and seminar as tangible indicators of progress and mastery of **Specific skills, Competencies, Concepts, Learning outcomes (SCCLs)**

- Badge-issuing platform will allow students to share with prospective employers digitally and/or in job application materials

Icons modified after: http://thenounproject.com/
Badge system

Field activities and badges will span 4 broad disciplines: geology, geomorphology, hydrology, ecology

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<tr>
<th>Topic</th>
<th>Activity</th>
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<tbody>
<tr>
<td>Geology</td>
<td>Bedrock Geologic Mapping: Students map and describe bedrock lithology, surficial deposits, and bedrock structures at Fish Springs Cinder Cone and Poleta Folds and use lidar data and aerial photos to complement their field interpretations.</td>
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Evidence of specific SCCL acquisition

**Geospatial Reasoning**: Accurately locate geologic contacts, correctly and completely describe each lithology, and label map appropriately.

**Experimental Design**: Apply and articulate geoscientific habits of mind to the construction of a geologic field map (e.g. rationale for planning traverses).

**Systems Thinking**: Write a narrative describing the geologic history based on the mapped bedrock and surficial deposits (e.g. periods of erosion, periods of deposition, environment of deposition, timescales of processes.)
Field Topics/Badges

**Mapping:** Geomorphic (moraine chronology), Ecological (vegetation transects), Bedrock (stratigraphy)

**Hydrology Methods:** Defining reaches, gauging streams, measuring discharge, mass balance, nutrient budget, pebble counts

**Other badges:**
- Field Notes
- Botany Methods
- Mass Balance
- Experimental Design
- Systems Thinking

![Moraine Chronology](image1)
![Bristlecone Pine Forest](image2)
![Geothermal: Hot Creek](image3)
![Poleta Stratigraphy](image4)
![Owens Valley Fault](image5)
![Mono Lake Water Budget](image6)
Challenges and Opportunities: Badges

**Challenges: Technical**

- Online hosting platform: expensive, changing rapidly, not necessarily accessible to all institutions
- Standardization: alignment to curriculum and community buy-in (?)

**Opportunities: Benefits all parties**

- Aids faculty in planning course activities and set learning objectives at specific levels
- Helps students plan degree path
- Facilitates communication between students and potential employers
Multi-institutional
College of the Atlantic (COA) institutional profile

- Private, rural, not-for profit, primarily undergraduate 4YC
- ~350 undergraduates
- 18% international students; 17% from Maine; 67% women
- All graduates earn B.A. in Human Ecology
  - May focus on ecology, environmental science, marine biology, GIS, etc.
- Self-designed, field-based courses, interdisciplinary curriculum; sustainability emphasis

Located in Bar Harbor, ME
Mt. San Antonio College (Mt. SAC) institutional profile

- Single-campus suburban community college (2YC) in LA County
- ~35,000 credit students; high percentage of underrepresented populations in the geosciences
- AA Natural Sciences; AA Environmental Studies
  - Courses in geology oceanography, meteorology, astronomy; mostly introductory-level
  - Field trips in most classes

Located in Walnut, CA
University of San Francisco (USF) institutional profile

- Private, urban, non-profit, Jesuit, primarily undergraduate 4YC
- ~7000 undergraduates; 26.1% Asian; 20.7% Latino/Hispanic; 4.5% African American
- B.S. in Environmental Science
  - curriculum: geology, hydrology, GIS, energy, ecology, wetland ecology, marine ecology, environmental toxicology
- Environmental Science major has doubled over past 5 years; ~50 students at present

Located in San Francisco, CA

www.usfca.edu
Challenges and Opportunities: Multi-institutional Planning

**Challenges: Administrative**

– Scheduling difficulties due to differences in:
  • term lengths, deadlines and enrollment mandates,
  • course credit and content hour requirements,
  • financial aid

**Challenges: Curricular or Extracurricular**

– Disparities in student content knowledge and field skills

– Demands on students’ time: research opportunities, work, internships, etc.
Challenges and Opportunities: Multi-institutional Planning

Opportunities: organically transformative experience

– Students and faculty practice communication, teamwork, and problem solving with people with common interests but different backgrounds

– Disciplinarily isolated faculty can practice professional development and share teaching/research strategies

– Students-to-student advising: informal mentorship, share study habits, share work/life experiences, etc.
Stay tuned for updates after the Cohort 1 field season, June-July 2017!

Thank you

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