An Environmental Field and Career Preparation Program for Students at 2-Year and 4-Year Institutions:

A Report on Student Attitudinal Changes, Skill Acquisition, and Lessons Learned From a Multi-Institutional Collaboration

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ESTEM collaborating institutions

COA: private 4YC in rural Maine; ~350 students

Many students from groups historically underrepresented In STEM

No field course for environmental students

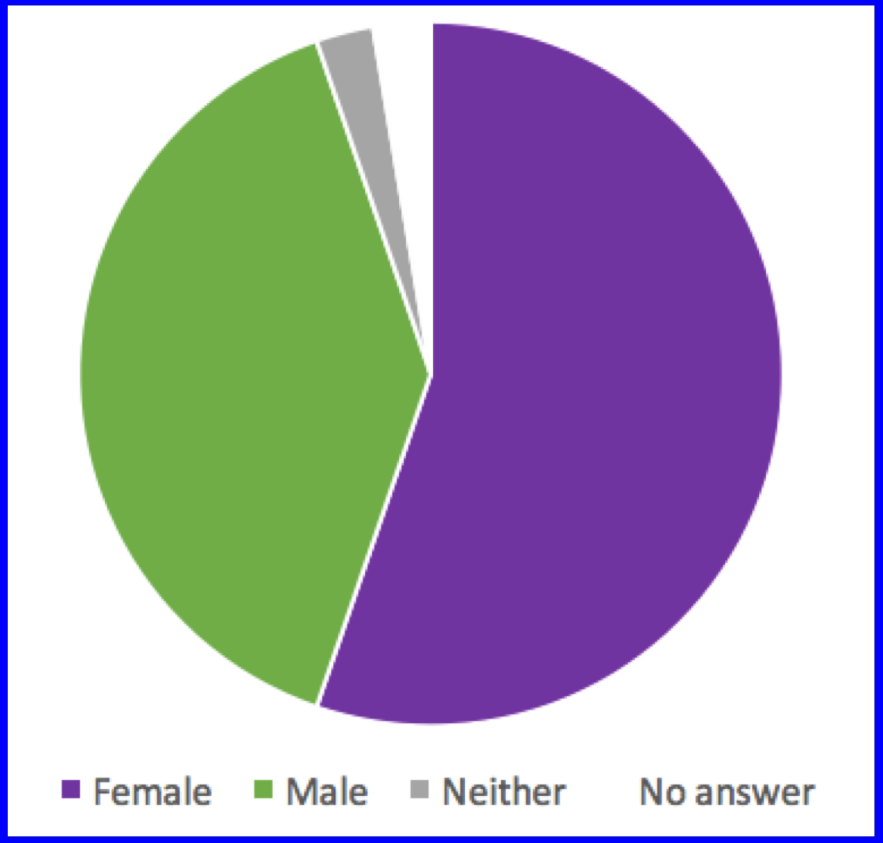
USF: private, urban 4YC with ~7000 undergrads

Mt. SAC: 2YC in LA County; ~35,000 students

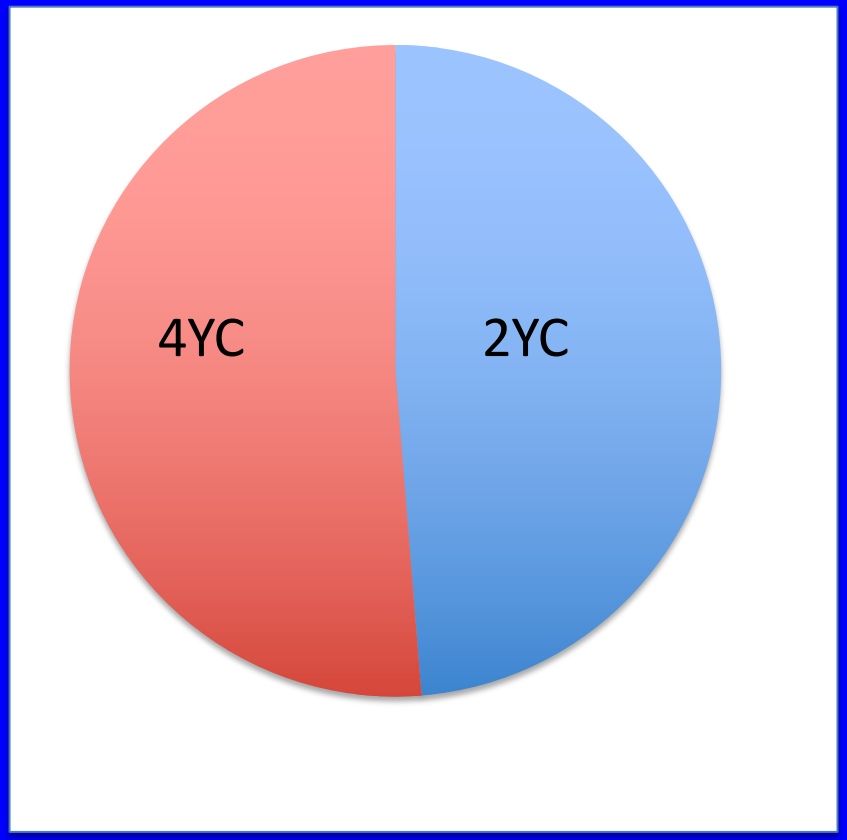
ESTEM objective	program components
Expand student awareness of traditional and nontraditional geoscience career options and the skills and content knowledge beneficial in preparing for these careers.	✓ spring/summer Sierras field program ✓ interaction with stakeholders ✓ post-field career activities
Facilitate student development of professional networks in the geoscience community prior to their transition and/or the workforce.	✓ interaction with stakeholders ✓ post-field career activities
Develop a system for documenting and archiving student career preparation and skills acquisition.	✓ assessment rubrics linked to essential skills as identified by stakeholders ✓ badges ✓ career-related assignments

ESTEM student population

gender

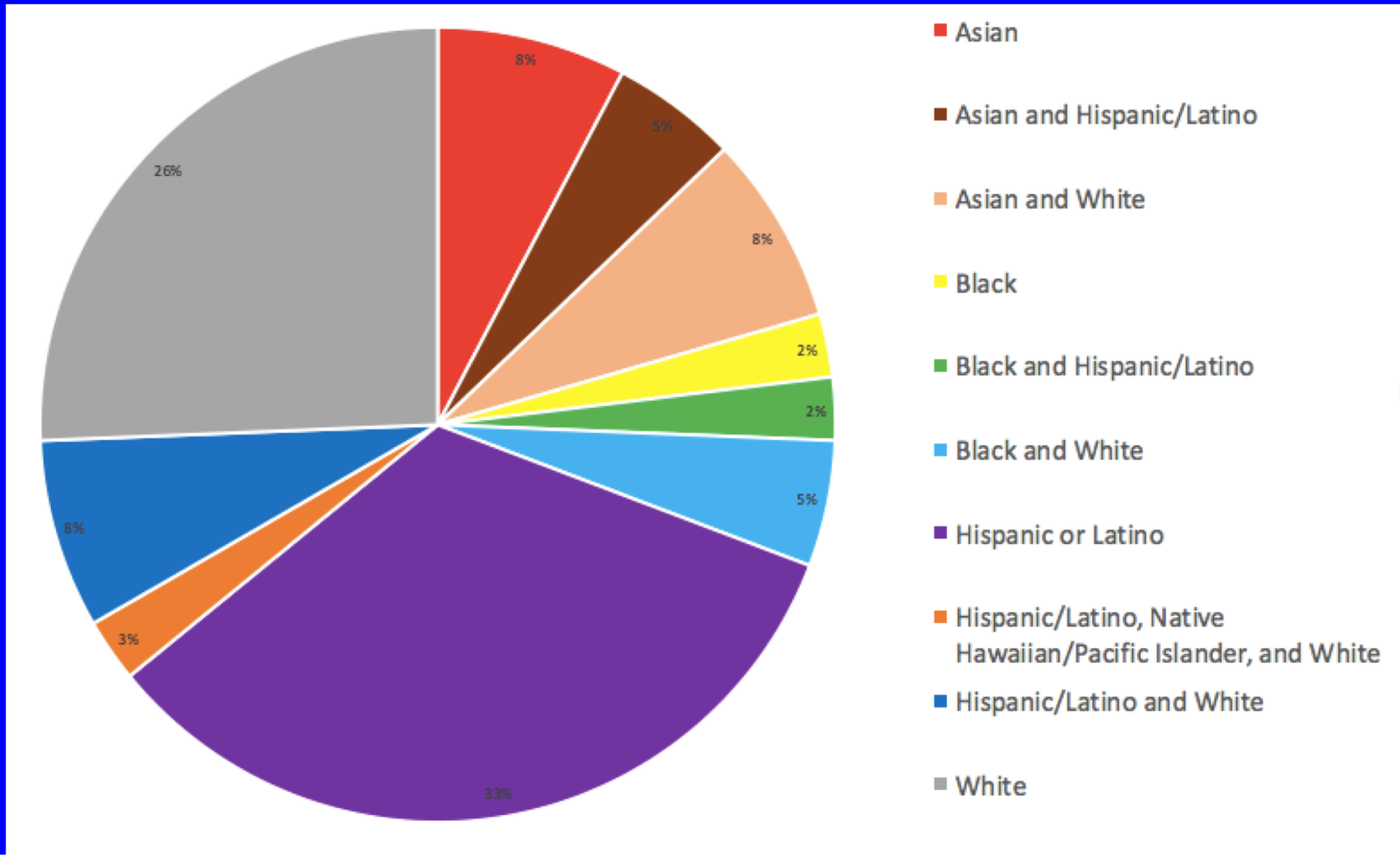


institution type



ESTEM student population

ethnicity



ESTEM field projects

Geology:

- ✓ bedrock, paleoshoreline, and soil stratigraphy

Geomorphology:

- ✓ moraine and fluvial terrace mapping

Hydrology:

- ✓ stream discharge, groundwater monitoring

Botany:

- ✓ belt and line transects, botanical observations

Integrated field project examples:

- ✓ vegetation, bedrock, and soil mapping, Bristlecone Pine Forest
- ✓ terrace surveys and pebble counting, Mono Lake North
- ✓ eruptive history and geomorphic characterization of Panum Crater

skills identified as critical by stakeholders

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instructional objectives for field exercises

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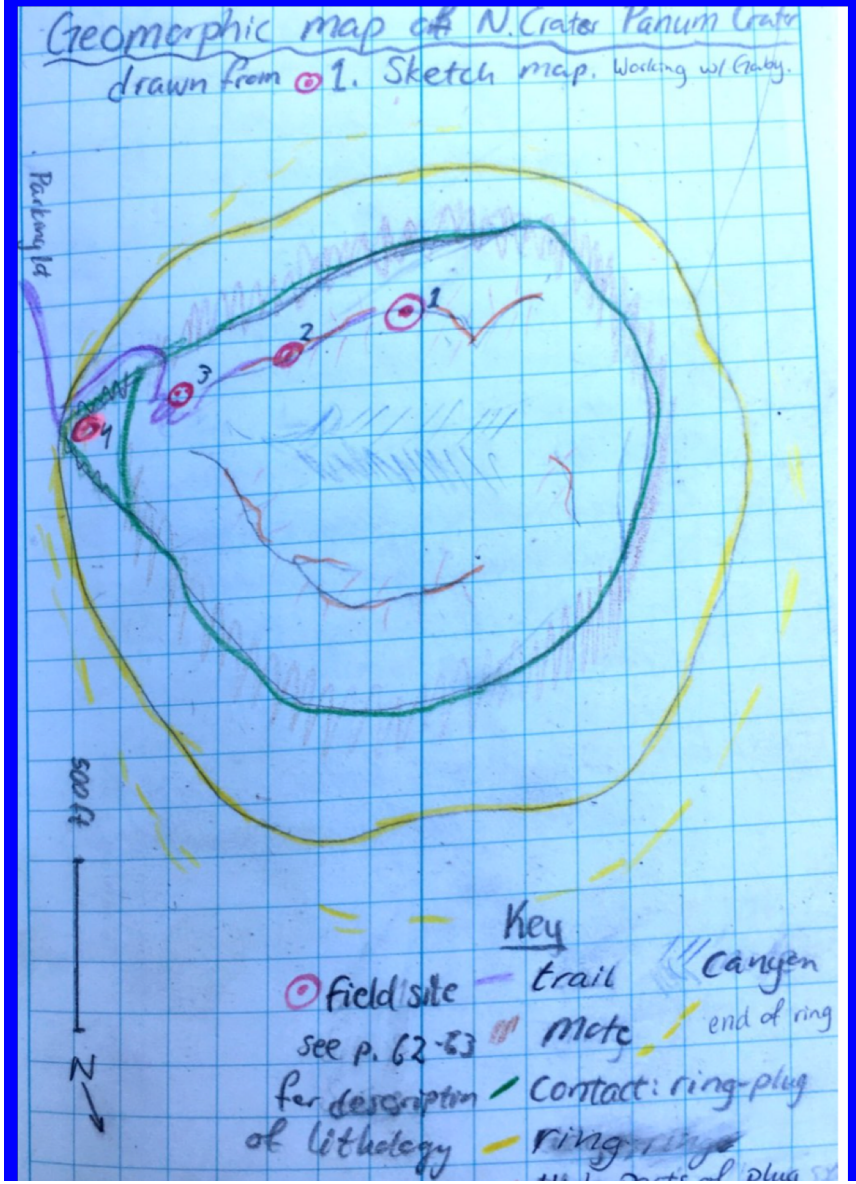
assessment rubrics



Field notebook badge information and scoring rubric Panum Crater

Data

Exceeds the standard	Meets the standard	Does not meet the standard
More than 95% of the recorded field data are recorded correctly (true to what student measured) **AND** More than 95% of the recorded field data recorded is accurate (correct measurement) **AND** More than 95% of the recorded field data are complete	More than 50% of the recorded field data are recorded correctly (true to what student measured) **AND** More than 50% of the recorded field data recorded is accurate (correct measurement) **AND** More than 50% of the recorded field data are complete	Less than 50% of the recorded field data are recorded correctly (true to what student measured) **AND/OR** Less than 50% of the recorded field data recorded is not accurate (correct measurement) **AND/OR** Less than 50% of the recorded field data are complete

Interpretation

Exceeds the standard	Meets the standard	Does not meet the standard
Interpretations by student recorded in the field book are aligned with or supported by the data recorded **AND** Interpretations are plausible based on prior scientific results.	Regardless of plausibility, interpretations made by student and recorded in the field book are aligned with and supported by the data recorded.	Interpretations made by student and recorded in the field book are not aligned with or supported by the data recorded.

Systematic nature of field notes: thoroughness

Exceeds the standard	Meets the standard	Does not meet the standard
Field notes include more than 95% of important site-specific information. **AND** Field notes include some notes on any known errors/assumptions, if applicable. **AND** Field notes include useful information beyond the data and observations required for the immediate field site.	Field notes include more than 75% of important site-specific information. **AND** Field notes include some notes on any known errors/assumptions, if applicable.	Field notes are missing more than 25% of information specific to the field sites/activities.

Great job noting extras like outcrop character, vegetation changes, etc.

Systematic nature of field notes: organization and clarity

Exceeds the standard	Meets the standard	Does not meet the standard
N/A	Entries are linked to a completed table of contents; **AND** Field notes display a regular pattern of location of components; ✓ **AND** Organization such that information is easily found by the reader. ✓	Entries are not linked to a table of contents. **AND/OR** Field notes are disorganized with respect to finding information. **AND/OR** Field notes much extraneous information in an unorganized way to muddle the important data/observations

Systematic nature of field notes: inclusion of components

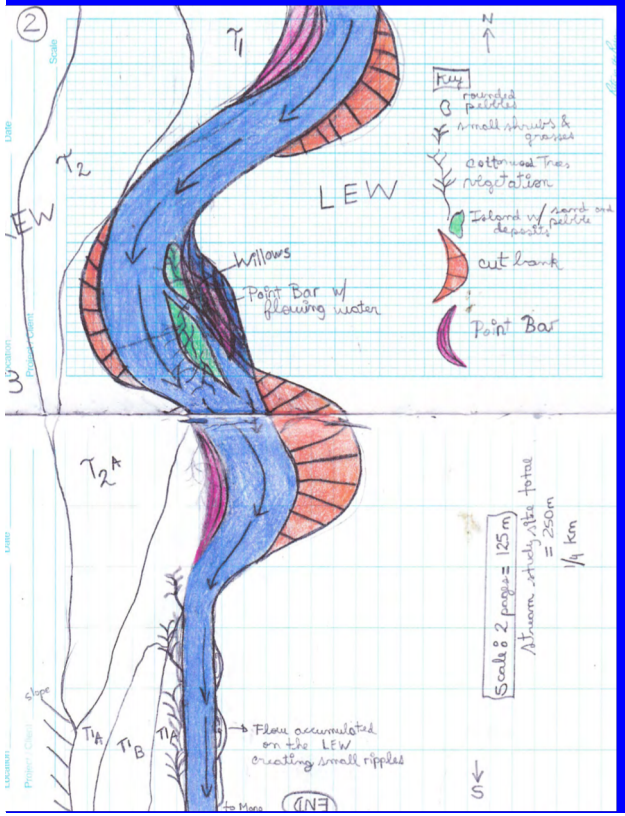
Exceeds the standard	Meets the standard	Does not meet the standard
Field note entry includes all of the following components: --date ✓ --location ✓ --field partner (if applicable) ✓ **AND**	Field note entry includes all of the following components: --date ✓ --location ✓ --field partner (if applicable) ✓	Field notes are missing one or more of the following components: --date --location --field partner (if applicable)

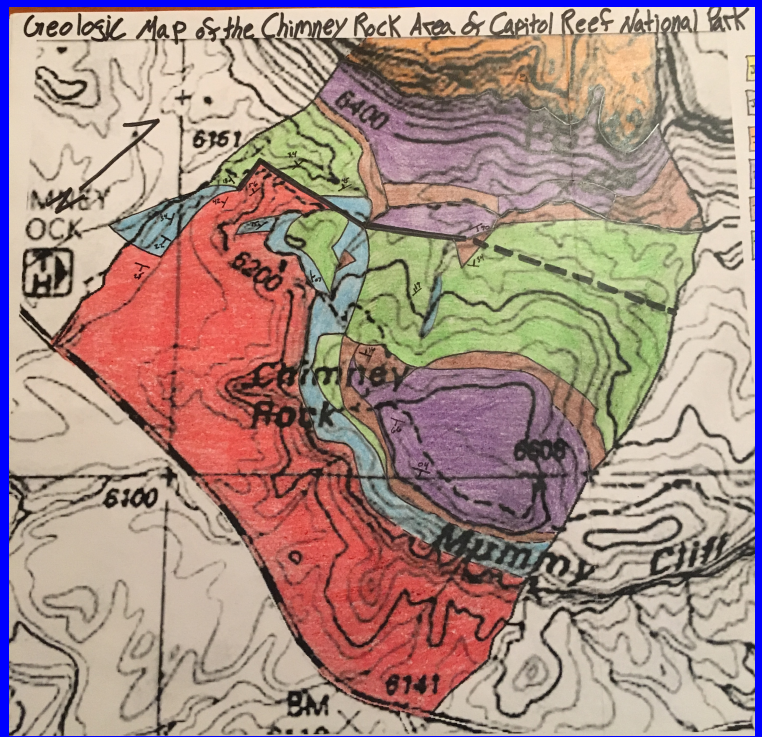
Nice job on this part.

Badges, badges, badges

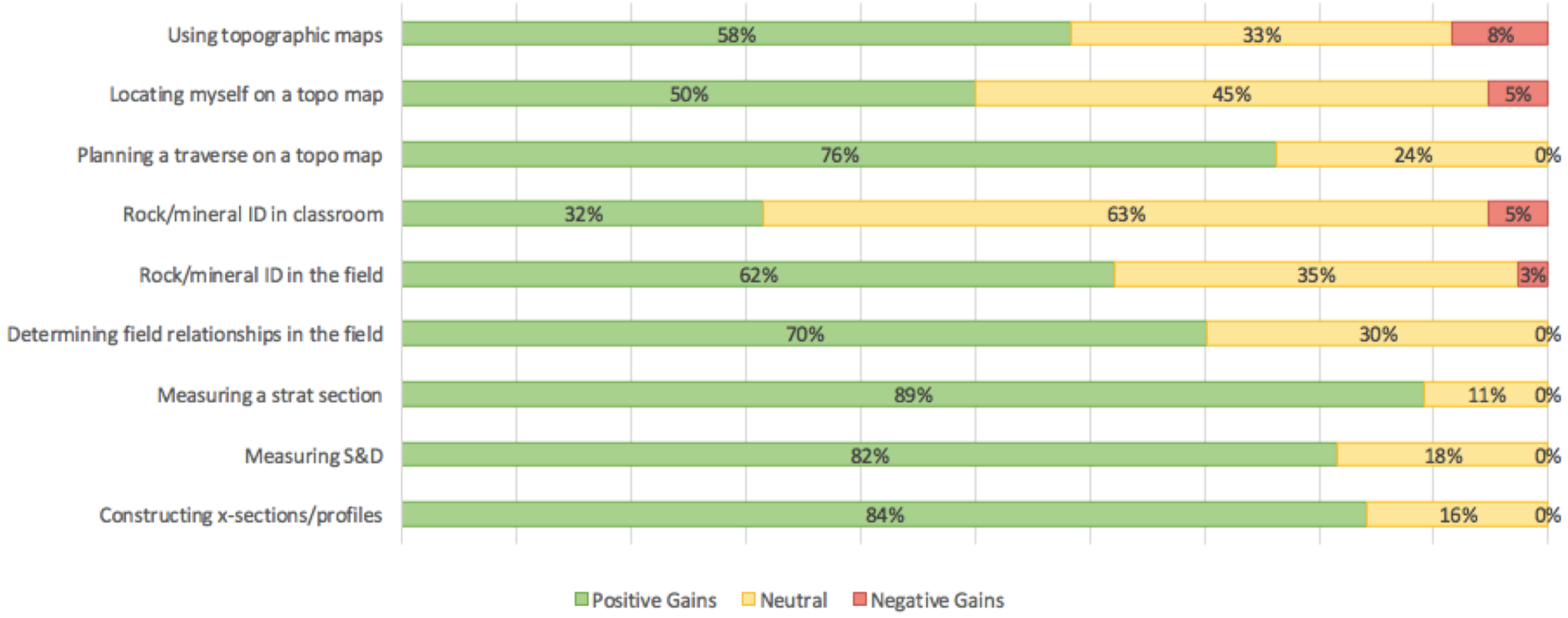
- "badge": symbol that recognizes skills, knowledge, accomplishments
- tangible indicators of progress in skills and competency "mastery"

- 2017: developed mapping and field notes badges and argued
- 2018: developed hydro methods and botany methods badges
- In progress: conferring badges and developing badge-issuing platform

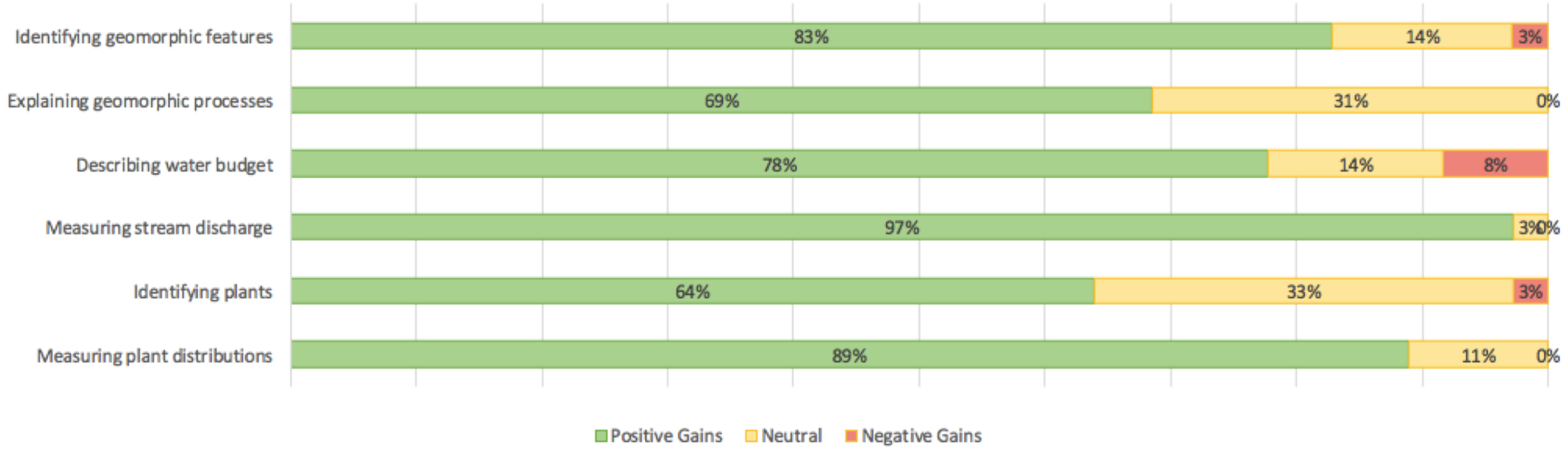




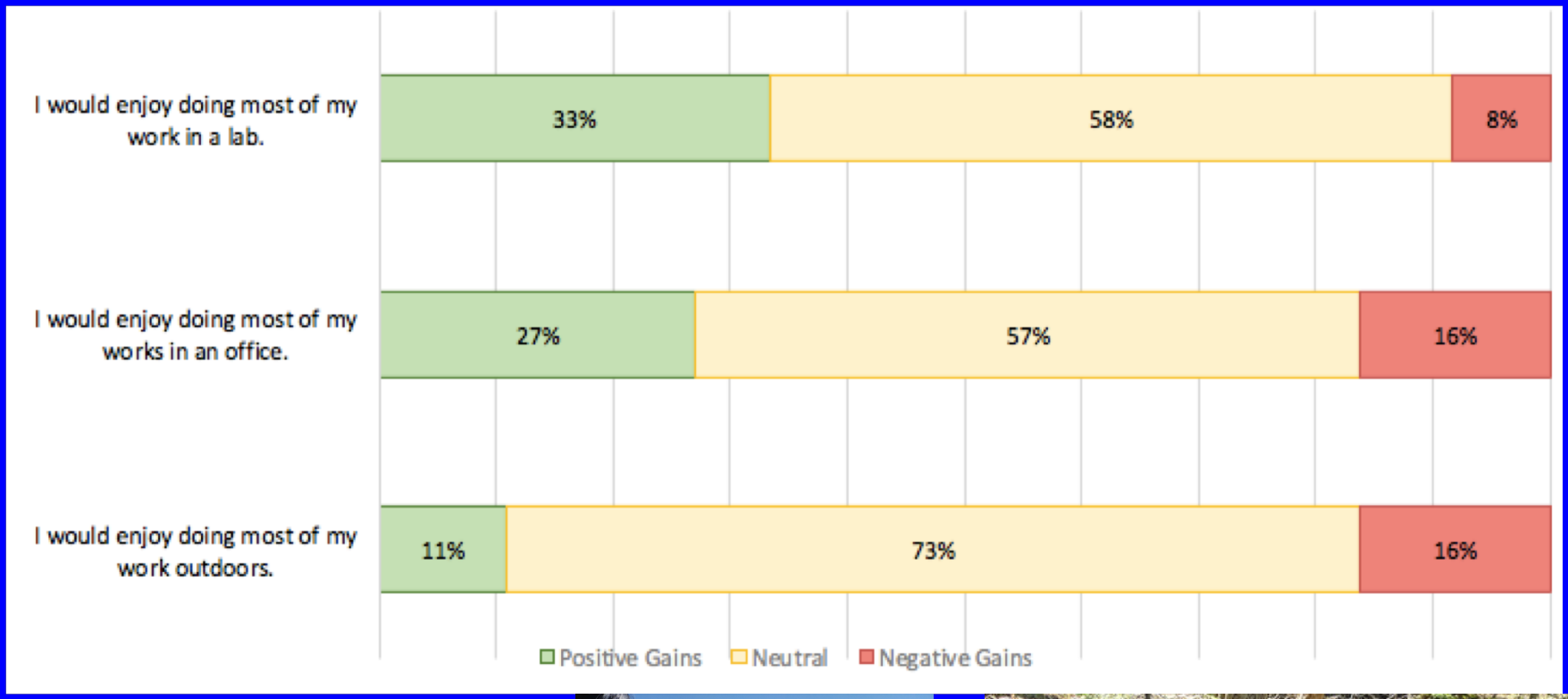
Changes in student perception of field skills: geology



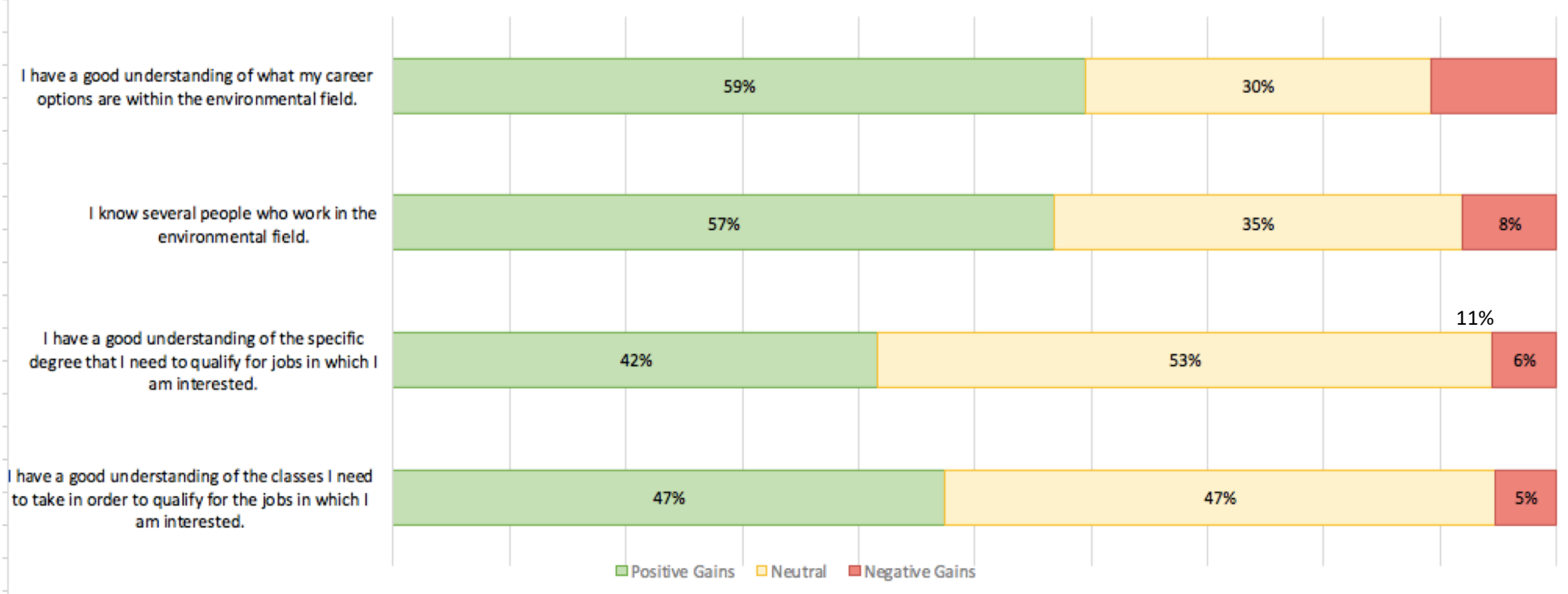
Changes in student perception of field skills: hydrology, botany, geomorphology



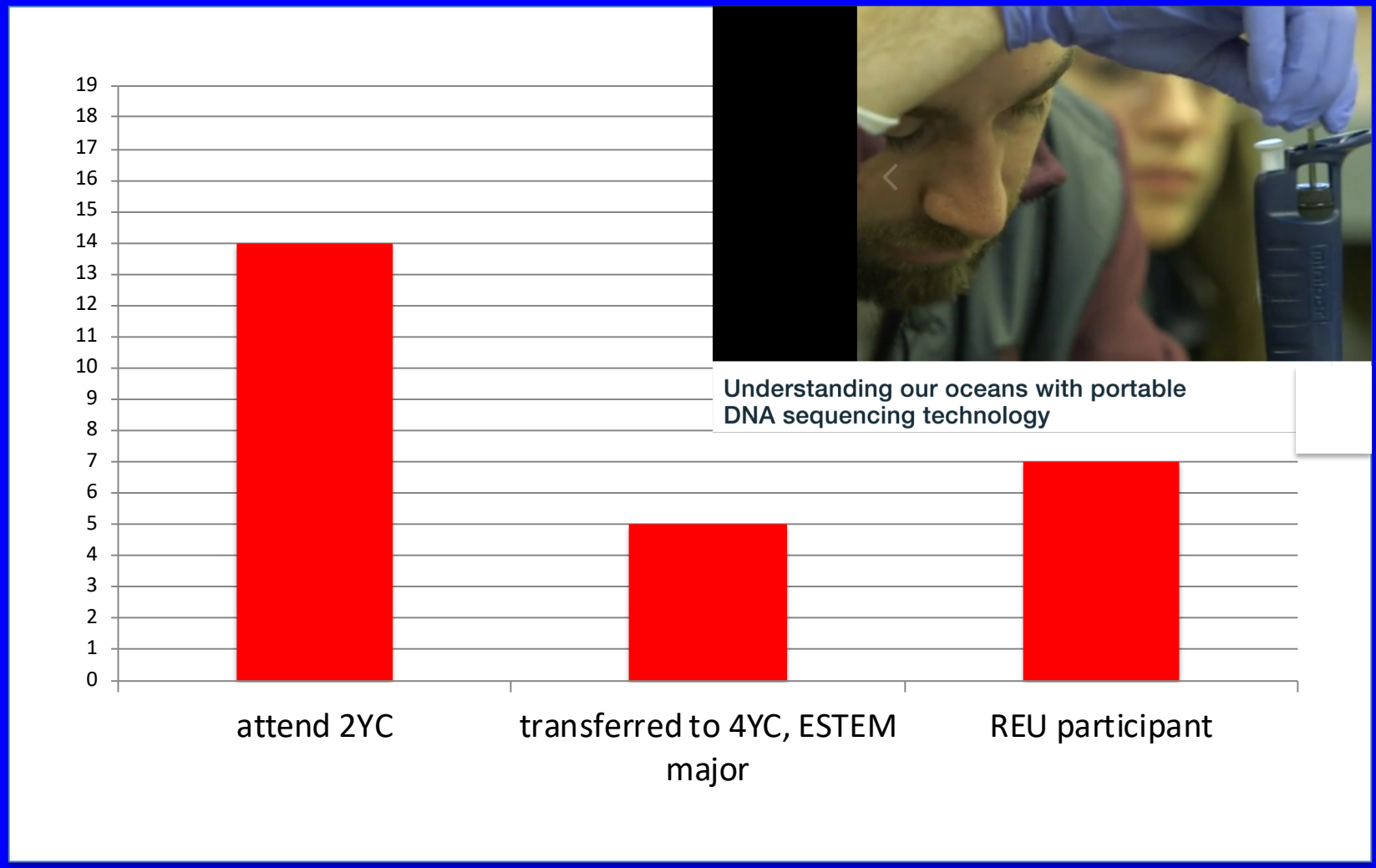
Changes in student attitudes about work environment



Changes in student knowledge of environmental careers



Outcomes for 2YC ESTEM students (n = 19)



Ongoing work and considerations

- What we're (still) working on:
  - assessment: curious about self-reported skills acquisition vs. rubric results
  - program evaluation, webpage construction, dissemination

- Sustainability needs:
  - stakeholder buy-in: hasn't been a problem, provided that their schedules can be accommodated
  - various curricular and institutional hurdles
  - *****funding: largest operating expense was tuition for 4YC students; 2YCs may be the key to minimizing budget!