

CONFERENCE-BASED UNDERGRADUATE EXPERIENCES:

LOWERING THE BARRIER FOR LEARNING ABOUT COMPUTATIONAL BIOLOGY

Anna Ritz

Assistant Professor of Biology

Reed College, Portland, OR



SCIENTIFIC MEETINGS

Conferences are the cornerstone of CS dissemination



**GREAT LAKES BIOINFORMATICS
CONFERENCE** May 19-22, 2019

The University of Wisconsin-Madison

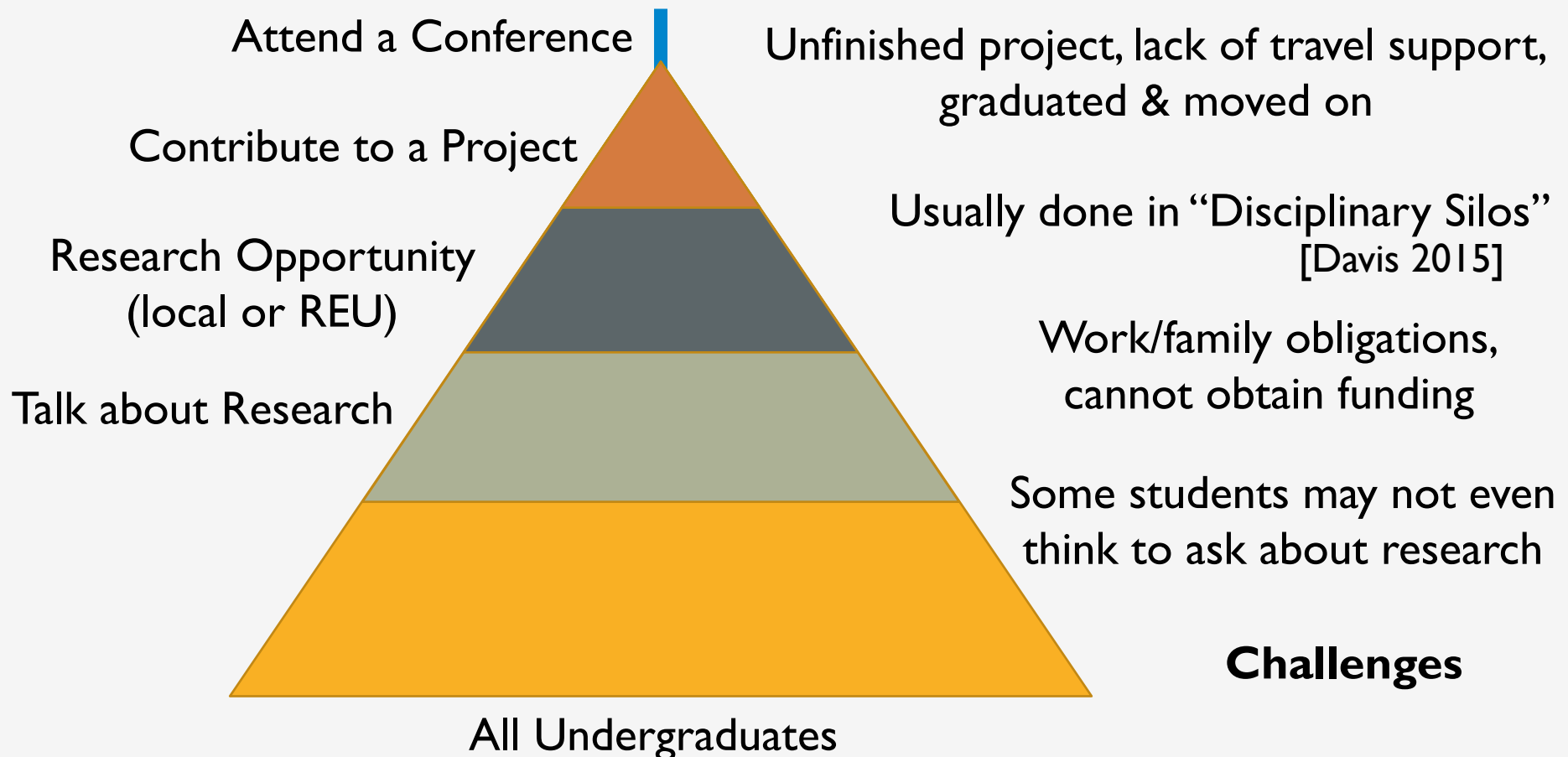


Undergraduates can benefit from conference attendance

- See how **real research** is done
- Get a **broad sense** of active research (even if it's hard to understand)
- **Network** with PIs who may be looking for graduate students

SCIENTIFIC MEETINGS

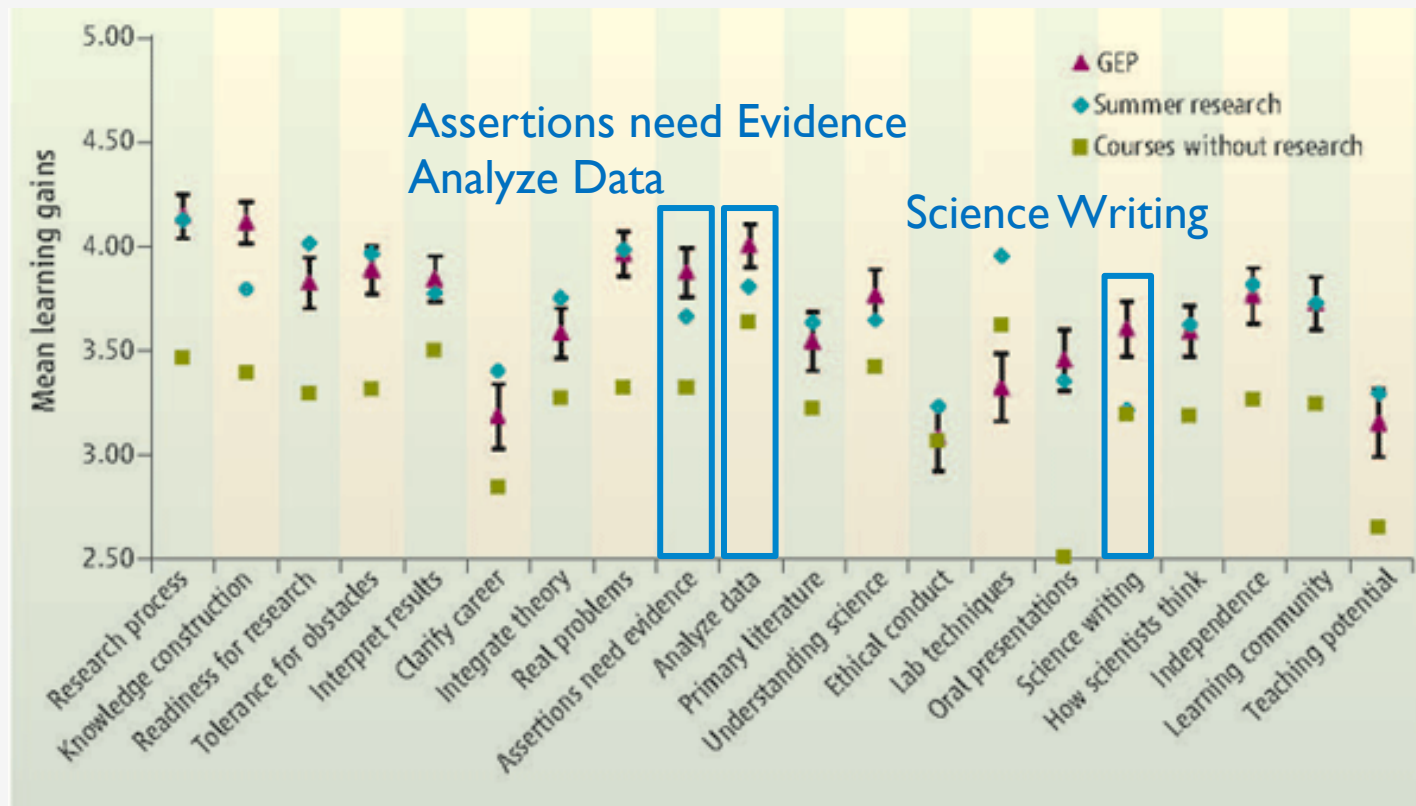
The catch: which undergraduates get this opportunity?



COURSE-BASED UNDERGRADUATE RESEARCH EXPERIENCES (CURES)

The goal: Expose more undergraduates to research

An Example: the Genomics Education Partnership (GEP) [Lopatto 2008]



CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

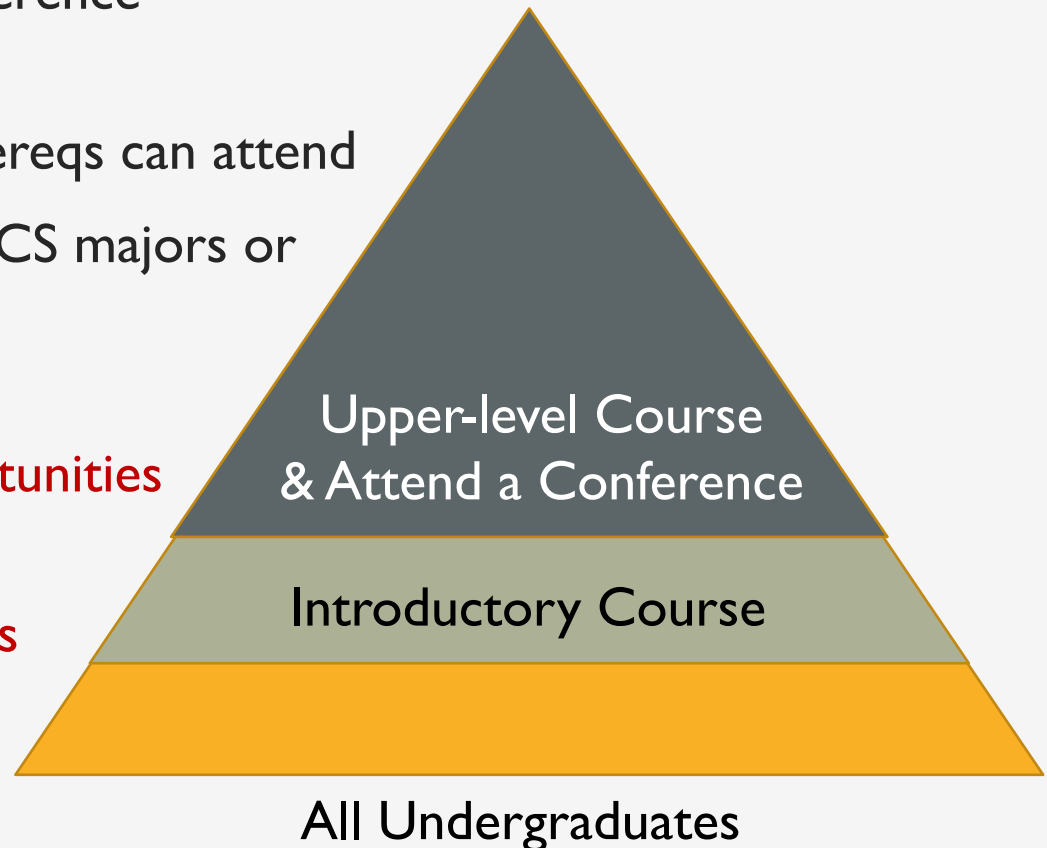
Integrate conference attendance with a course

Lowers the barriers for conference attendance

- Any student with the prereqs can attend

Students are not necessarily CS majors or interested in graduate school

- Focus on learning about research and career **opportunities**
- Goal is for students to **clarify their career interests**



CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

Why did we do this?

- Scientific Conferences
- Integration in a Course



CCF #1643361
(2016-2017)

How was it implemented?

- The Institution & Course

What's next?

REED COLLEGE (PORTLAND, OR)

Private Liberal Arts Institution

- About 1,400 undergraduates
- About 140 faculty
- Year-long intensive senior thesis

Biology Department

- 11.5 Faculty (one of the largest)
- Emphasis on research (informally)

Computer Science Department

- 3 Faculty (est. this year)
- CS Major established
Fall 2017

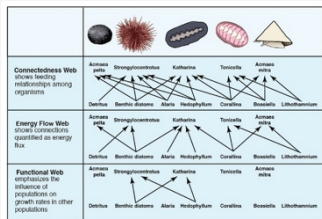


Students have **deep research experiences**
in a **limited number of fields**

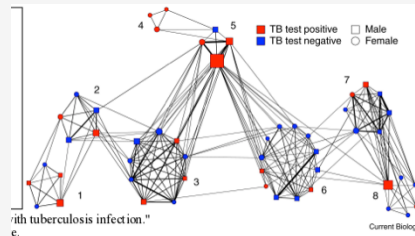
Photo credits: Bruce Forster; Stacey Kim

BIO33 I: COMPUTATIONAL SYSTEMS BIOLOGY

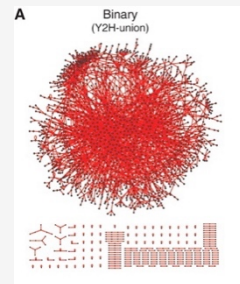
- “Applied Graph Algorithms” implementation-heavy course (Python)
- **Prerequisites:** Intro to CompBio (BIO131) or CSI + some bio



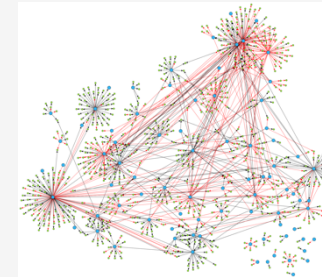
Food Webs



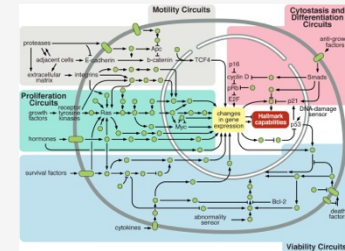
Animal Social Networks



PPIs



GRNs



Signaling Pathways

NSF Grant for Undergraduate Travel

- Implemented the 1st time BIO33 I was offered
- Students didn't know conference travel would be part of the course
- Grant funded an additional two students to ACM-BCB 2017



CCF #1643361
(2016-2017)

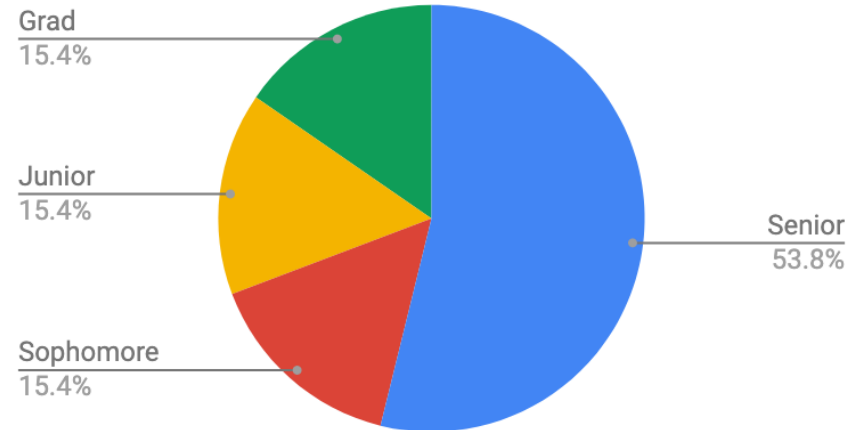
STUDENT MAKEUP

Thirteen Students

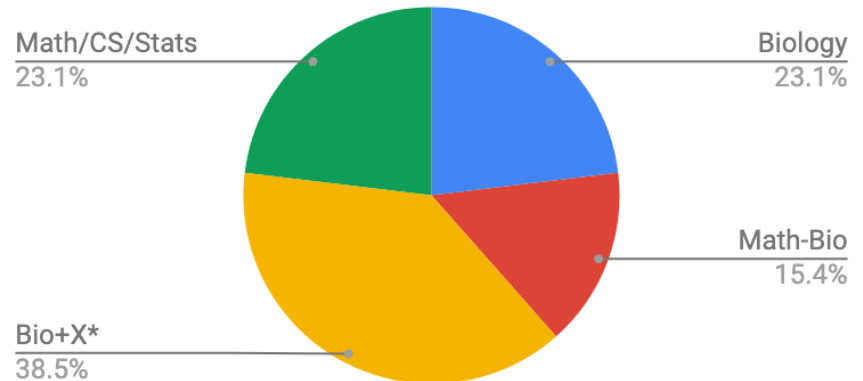
- 7 students in BIO331
- 4 students from Intro to Comp Bio
- 2 recent graduates living in Seattle
- 38% women; 31% URM



Year @ Time of Conference



Majors @ Time of Conference



CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

Why did we do this?

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CCF #1643361
(2016-2017)

How was it implemented?

- The Institution & Course
- The Conference

What's next?

ACM-BCB 2016 (SEATTLE, WA)

Flagship conference of the ACM SIGBio

- **Intentionally Broad:** CompBio, Bioinformatics, and Health Informatics
- Relatively **diverse** in terms of women, PIs from all career stages
- **Easy to Get To:** 3 hours by train
- **Relevant:** Workshop directly related to Computational Systems Biology
 - CNB-MAC: Computational Network Biology: Modeling, Analysis, and Control



ACM-BCB 2016

The 7th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics
Seattle, WA, October 2-5, 2016

STUDENT ASSIGNMENTS

Before the Conference

1. Read Abstracts from CNB-MAC
2. Prepare to field questions

During the Conference

Interpretive Time-Frequency Analysis of Genomic Sequences

Gene Expression Based Computation Methods for Alzheimer's Disease Progression using Hippocampal Volume Loss and MMSE Scores

Predictive Modeling of Drug Effects on Signaling Pathways in Diverse Cancer Cell Lines

Inferring Microbial Interaction Networks from Metagenomic Data Using SgLV-EKF Algorithm

SEQUOIA: Significance enhanced network querying through context-sensitive random walk and minimization of network conductance

DIGNIFI: Discovering causative genes for orphan diseases using protein-protein interaction networks

Detecting Communities in Biological Bipartite Networks

Comparison of tissue/disease specific integrated networks using directed graphlet signatures

SNP by SNP by Environment Interaction Network of Alcoholism

STUDENT ASSIGNMENTS

Before the Conference

1. Read Abstracts from CNB-MAC
2. Prepare to field questions

During the Conference

1. Submit **short summaries** of 3 **talks** and 2 **posters**

After the Conference

1. Write a 1-2 page **paper summary**
2. Write a 1-2 page reflection

Students could **choose**
which tracks & workshops
to attend

Independent Project

(BIO331)

1. Give a talk
2. Write a mini-paper

STUDENT ASSIGNMENTS

Field Trip! Computational Biology on the Road

Modified from an original blog post from <https://annamritz.wordpress.com>

Anna Ritz
Biology Department, Reed College
Portland, Oregon
aritz@reed.edu

ABSTRACT

A few weeks ago I took my students to the Association for Computing Machinery Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB) in Seattle, WA. It was a fantastic experience for everyone involved, and the organizers did an excellent job running the conference. I asked my students to reflect on the conference, and I figured I should do the same.

This report also highlights some features of the ACM LaTeX template. The original `bio331-sample.tex` file is available on Moodle.

Keywords

ACM; conferences; undergraduate research

1. MOTIVATION

When I learned that ACM-BCB 2016 was going to be held in Seattle, I jumped at the chance to take Reed students. ACM-BCB is a computer science conference focused on applications to computational biology and health informatics, and I have published there in the past [1]. My upper-level class, *Computational Systems Biology*, included a great mix of biology and math/CS majors. Thirteen Reed students attended ACM-BCB (Table 1).

1.1 Broader Impacts of Conference Travel

The timing and location of the conference coincided perfectly with my *Computational Systems Biology* class, and I received funding from the NSF for student travel. The grant, titled *A Course-Based Undergraduate Conference Experience in Computational Biology*, offers the following broader impacts (phrasing borrowed from the proposal abstract). First, it will promote interdisciplinary research by educating students about computer science applications within biology. Second, it will empower students with a unique opportunity that few undergraduates obtain, leading to an anticipated increased confidence in engaging in



Figure 1: The group before boarding Seattle's Great Wheel at Pier 57. From left to right: Elaine, Eli, Erik, Nick, Mina, Amy Rose, Yurel, Rose, and Karl. Not shown: Emily, Vikram, Danny, and Barney.

science and scientific research. Third, it will provide an opportunity for Principal Investigators (PIs) from other institutions to interact with strong interdisciplinary undergraduates.

1.2 Recruiting and Retaining STEM Students

As a computer scientist, I am interested in recruiting students to computational fields and supporting them if they decide to continue this line of study. My classes are interdisciplinary in nature, offering a unique opportunity to engage students in computational biology material. As I wrote in the NSF proposal, conference travel is available to **any** student to takes my upper-level class, encouraging students from both computational and non-computational backgrounds to attend:

The proposed travel is also a potential mechanism for recruiting underrepresented groups in STEM. The introductory computational biology courses in 2015-2016 included students from all years (freshmen through seniors) majoring in eight different areas (including four outside the Division of Math & Natural Sciences). Further, 60% of the students who completed the course were women, a group traditionally underrepresented in computer science. Thus, the pool of students eligible for the upper-level course (and the proposed conference travel) include a group that is diverse in terms of gender, class year, and declared major.

– NSF Proposal Abstract

Name	Year	Major	Bio331?
Amy Rose Lazarte	Sophomore	Alt-Bio	✓
Yurel Watson	Sophomore	Math-CS	
Elaine Kushkowski	Junior	ES-Bio	
Eli Spiliotopoulos	Junior	Biology	✓
Danny Heinz	Senior	Bio-Psych	✓
Erik Lopez	Senior	Math-CS	✓
Karl Menzel	Senior	Biology	✓
Mina Marden	Senior	Math-Stats	✓
Nick Franzese	Senior	Math-Bio	✓
Rose Driscoll	Senior	Alt-Bio	✓
Vikram Chan-Herur	Senior	Biology	✓
Barney Potter	'16 Graduate	Math-Bio	
Emily Merfeld	'16 Graduate	Bio-Psych	

Table 1: Reed students who attended ACM-BCB.

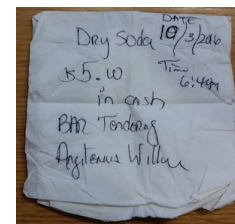


Figure 2: The napkin receipt.

2. REFLECTION

With such a large cohort of undergraduates at a scientific conference, my role shifted to encompass one of an educator as well as a researcher. I honed in on the accessibility of the material in talks, feeling a bit of pride when the speakers showed an image or mentioned a topic I have taught in class. I also had some moments of "wow, should have taught them that" when a speaker presented a fundamental concept we have not yet covered. Many of my students came out of sessions excited about what they had just learned. They talked with the speakers, asked for their papers, and are now delving into this new material. Graduate student attendees became mentors, fielding questions about why they went to graduate school and how they picked their research topic.

ACM-BCB was an ideal size – the conference had compelling talks and tutorials while being small enough to chat with the keynote speakers and conference organizers. I caught up with existing colleagues and met some potential collaborators in the Pacific Northwest. I also found myself in discussions with graduate students about my position in a liberal arts environment. Reed had a research presence, since three Reed students submitted posters to the poster session. My students had garnered enough research experience – either through their thesis, summer research, or independent projects in class – to have engaging conversations with other attendees.

2.1 Lessons Learned

The trip to ACM-BCB as a class taught everyone (including me) the importance of logistics. Some gems:

1. Make sure the taxi to the train station can fit the entire group.
2. Remember who you gave the posters to in your mad dash to find parking before your train departs (see #1).
3. Make sure your PCard credit limit is set so it's not declined at the hotel.
4. Tell your students the correct time of the first keynote.

And the question of the day: is a (very detailed) receipt for a can of soda written on a napkin by a bartender reimbursable (Figure 2)?

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Bio331 Fall 2016, Reed College, Portland, OR

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ACM ISBN X-XXXXX-XX-XXXXX.

DOI: XX.XXX/XXXXX

CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

Why did we do this?

- Scientific Conferences
- Integration in a Course



CCF #1643361
(2016-2017)

How was it implemented?

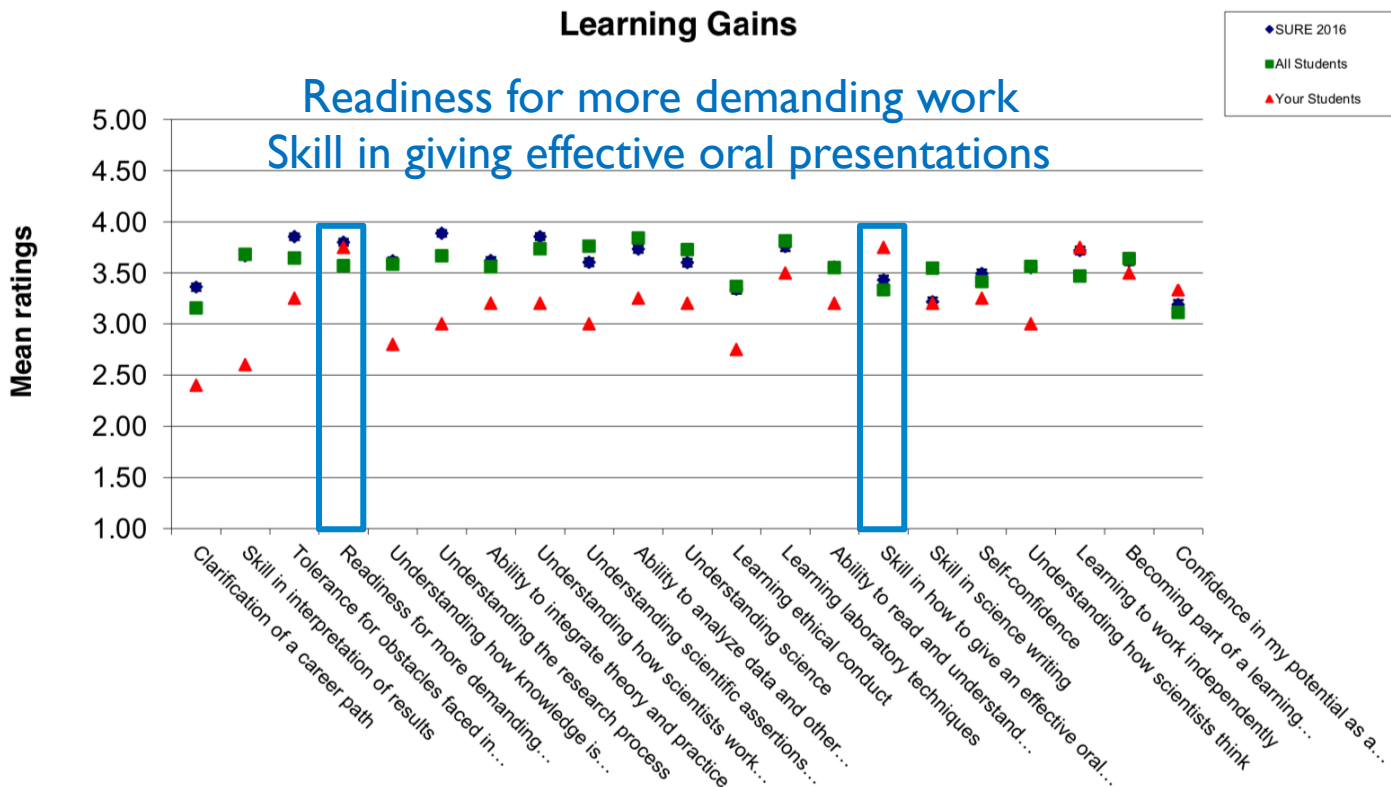
- The Institution & Course
- The Conference
- Student Experiences

What's next?

SHORT-TERM STUDENT RESPONSES CURE PRE- AND POST-SURVEY

CURE survey is not particularly informative

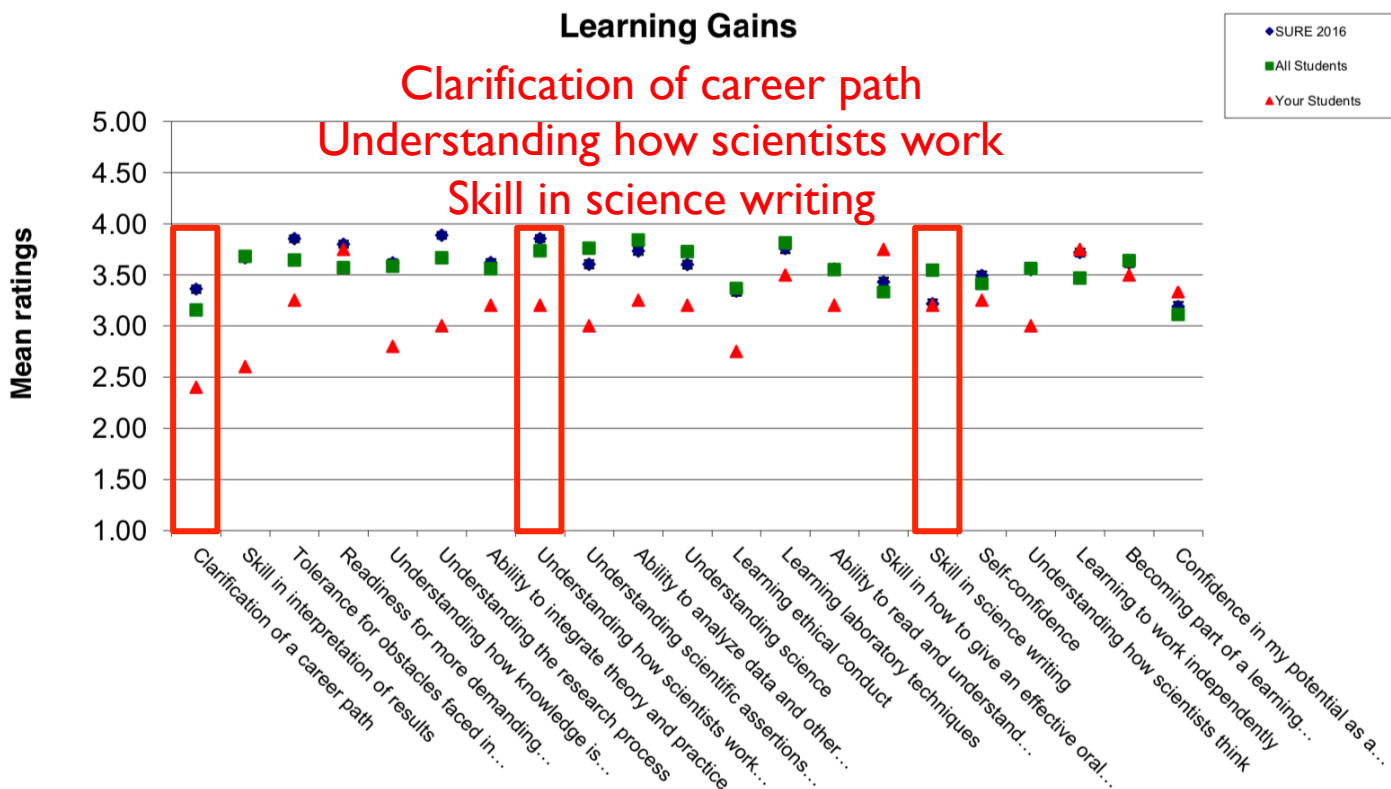
- 11 pre-test responses, 5 post-test responses
- Reed students already have ample course-based research experience



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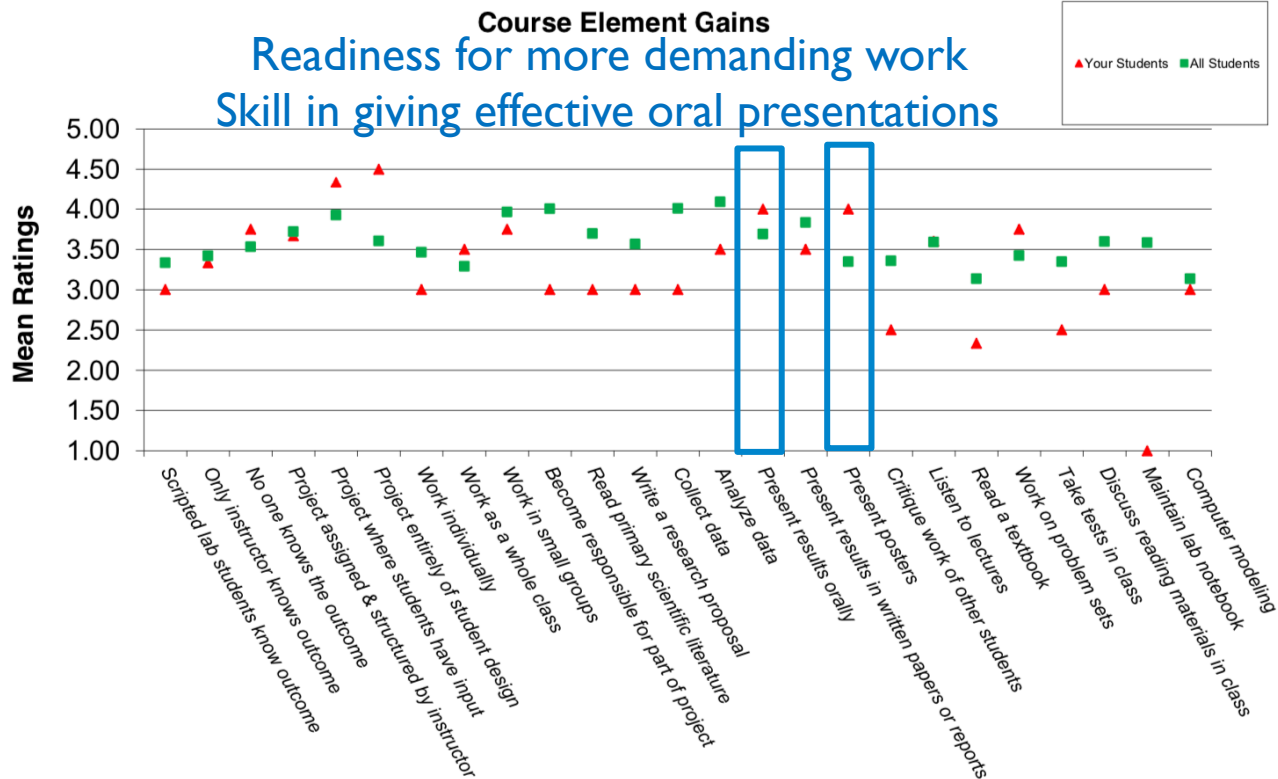


SHORT-TERM STUDENT RESPONSES

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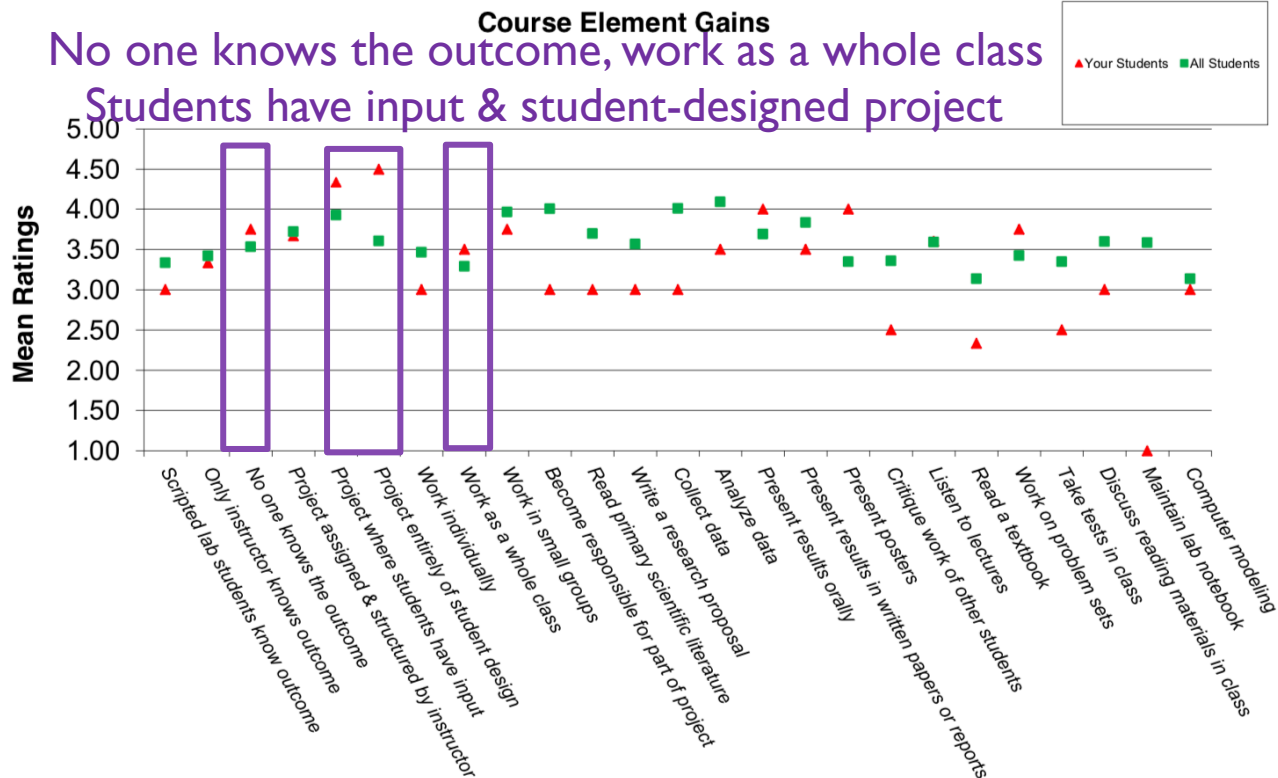
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UNEXPECTED (ANECDOTAL) OUTCOMES

Positive Outcomes

- Professional preparation was **useful for students**
- Grad students were **engaged in the process**
- **PIs got to meet undergraduates**, many of whom are considering graduate school

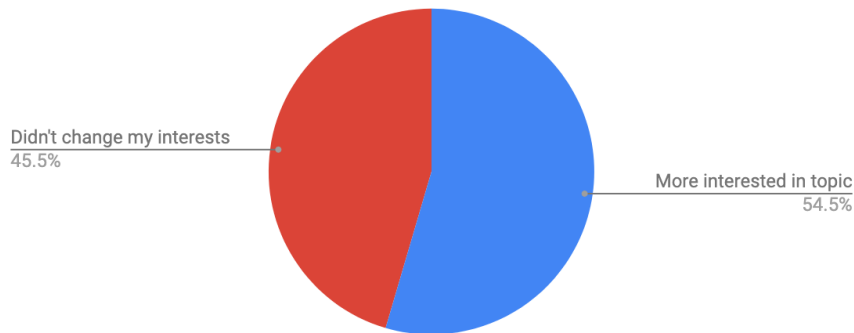
Not-so-positive Outcomes

- In one case, the **experience isolated a student even more**
- **Missing class was hard**, even for the exceptionally strong students
- Don't want to dilute the **quality of the meeting**

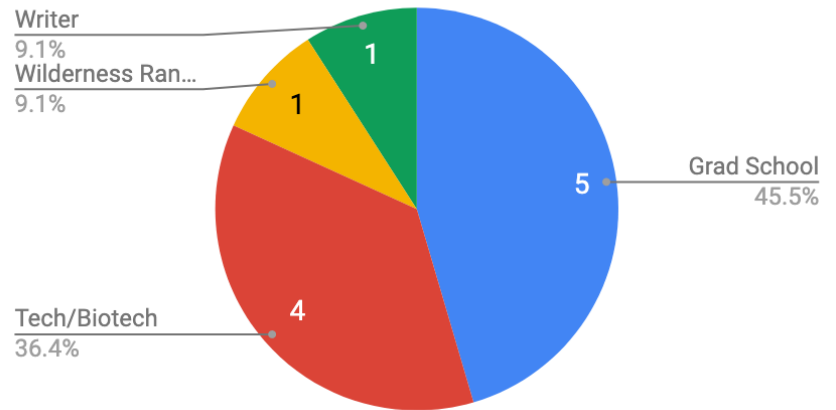
LONG-TERM STUDENT RESPONSES

April 2019 Survey: 11 respondents

Clarification of future interests (major, job, career)?



Current Job



Student Responses:

“Helped me figure out that I do eventually want to go to graduate school “

“It underlined the importance computational bio would continue to have on my career.”

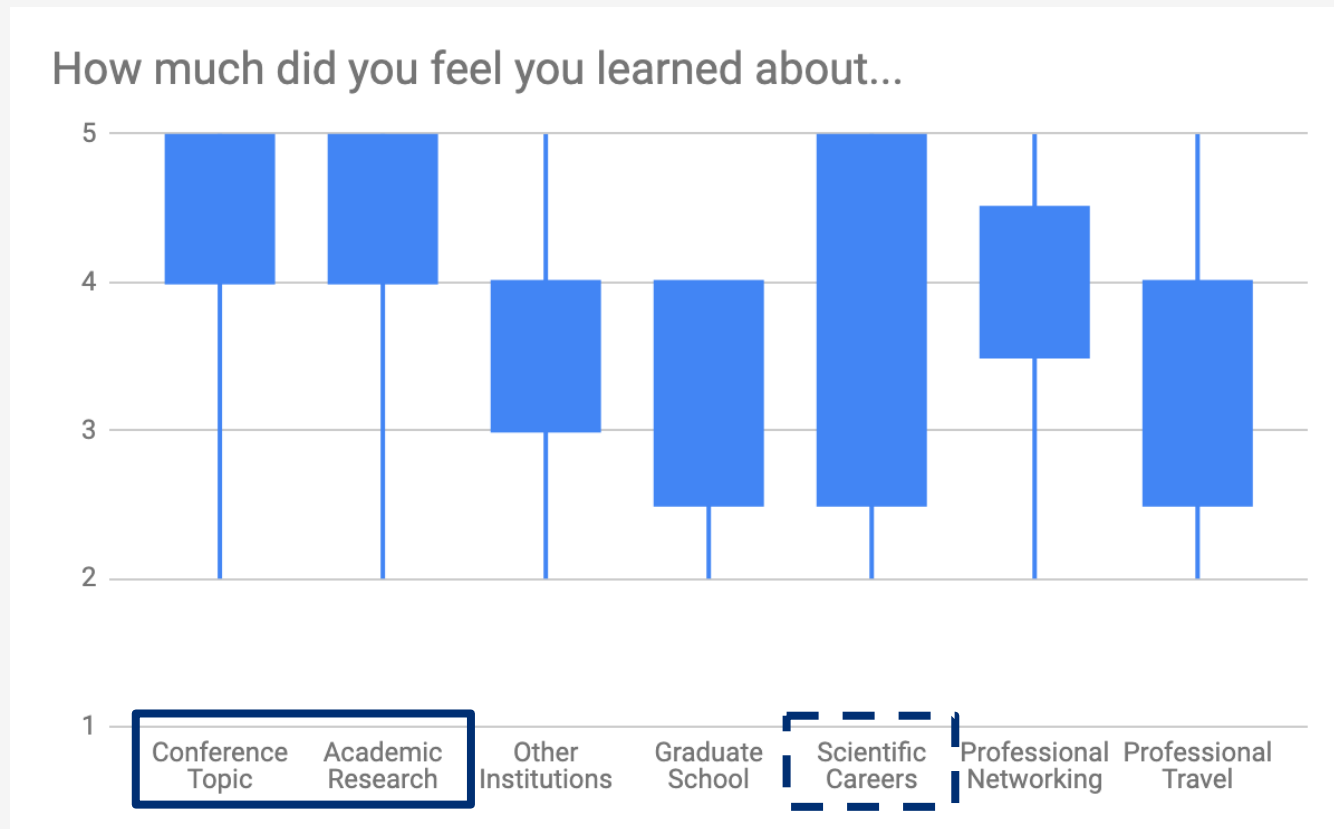
“Concreted that I wanted to go into academia”

“Helped me understand the importance of having both computational & biological understanding.”

“Meeting older students (including grad students) at conferences was part of what made me consider going to grad school.”

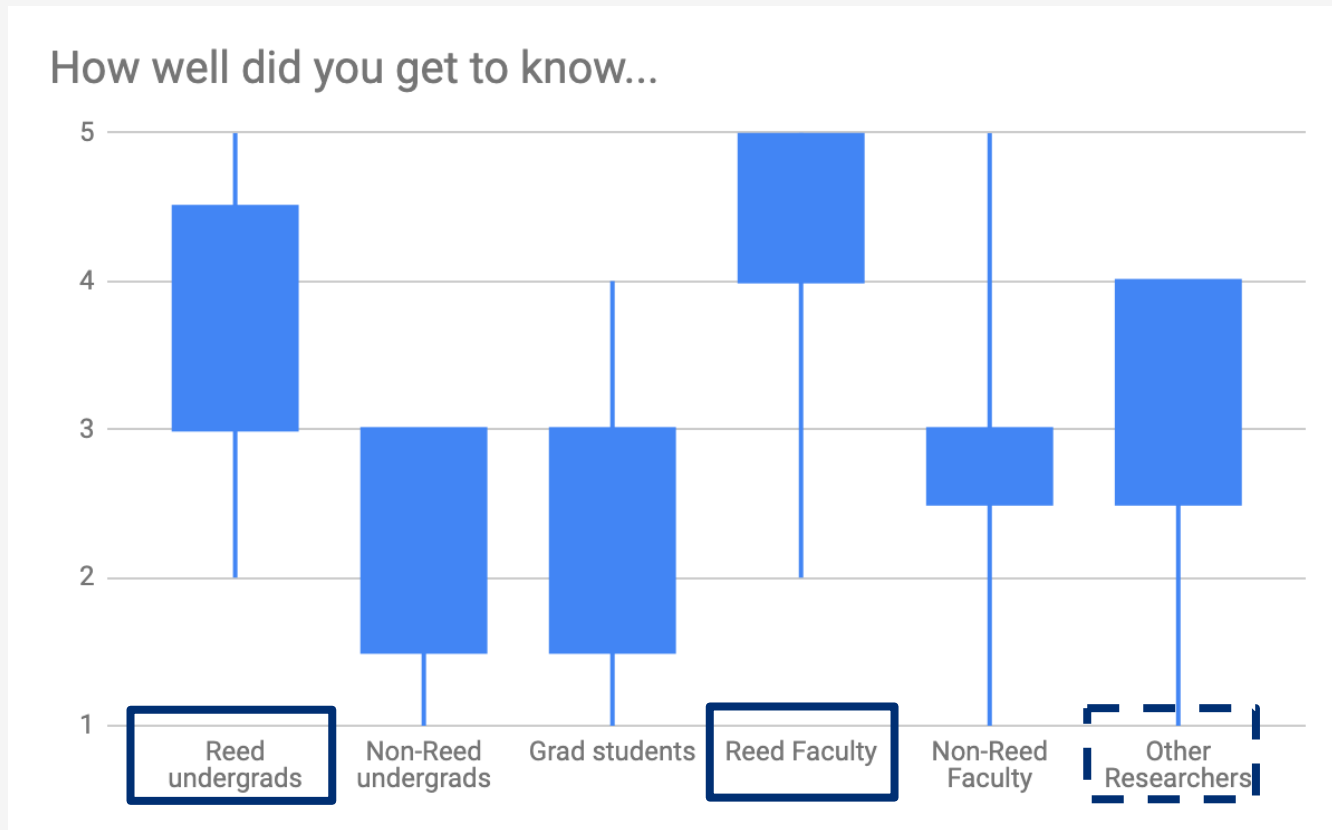
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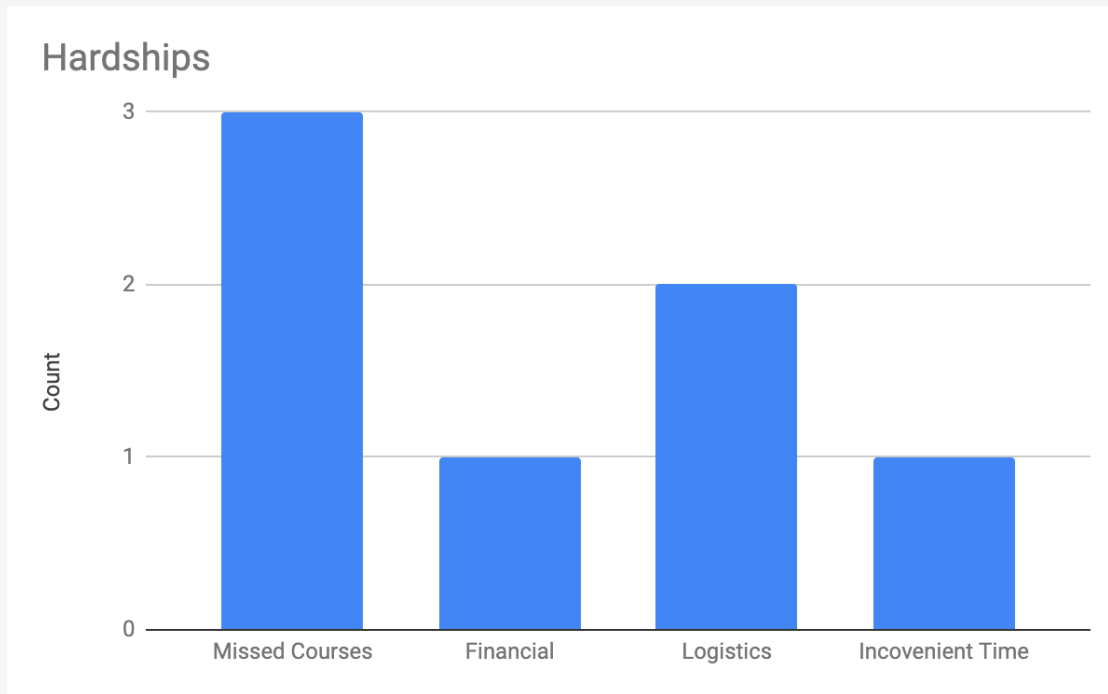
LONG-TERM STUDENT RESPONSES

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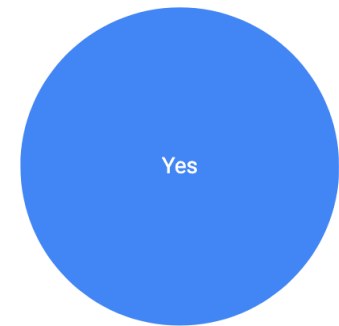


LONG-TERM STUDENT RESPONSES

April 2019 Survey: 11 respondents



Would you attend another conference?



Similar results for a larger set of 25 students who have attended scientific meetings (CS/compbio/cell bio)

CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

Why did we do this?

- Scientific Conferences
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(2016-2017)

How was it implemented?

- The Institution & Course
- The Conference
- Student Experiences



DBI #1750981
(2018-2023)

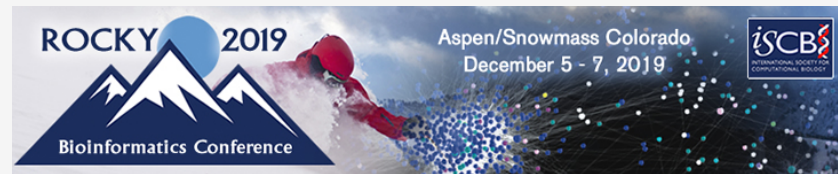
What's next?

LOCAL & NATIONAL INITIATIVES



Local Initiative: Bio331 Conference Attendance 2020-2023

- Travel to a meeting
- Reduce the impact of missed courses
- Scale with class size



?

The 10th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics

ACM BCB 2019

Niagara Falls, NY, Sept 7-10, 2019



National Initiative: ACM-BCB Student Scholarships 2020-2023

- Hotel & Registration for 10 students (preferred driving distance to BCB from resource-limited schools)
- No previous research experience necessary

Stay Tuned...

NEAR FUTURE: GUIDELINES FOR ATTENDING CONFERENCES

Conference Advice Template ☆

File Edit View Insert Format Tools Add-ons Paperpile Help Last edit was on September 20, 2018

50% Normal text Arial 11 B I U A

Outline

- Logistics
- Conference Attendance
- Conference Attire
- What to Bring
- What will people ask you?
- What can you ask people?
- Reimbursements

Logistics

[Include conference, hotel address, and contact information for faculty/students at the top of this email]

Conference Attendance

- Before the conference, carefully look at the program and plan out the main topics you want to attend.
 - The keynotes are usually very good general overviews of a sub-field
 - Track talks are more technical (discussing work from one paper, for example)
 - Vendor booths offer lots of swag and cool opportunities. Depending on the conference, make sure you have extra space for swag.
 - The poster session is the best chance to talk to people about their research. Posters are usually presented by graduate students or postdoctoral researchers, though sometimes the PI presents the work. This is a great time to learn about grad school from current students doing interesting work.
- When you first get to the conference, you will check in and pick up a conference program, a name tag, and other items. Often times conferences will let you get your registration packet the night or day before. Do it if you can. You'll avoid lines.
- Everyone will have a name tag denoting their affiliation. Put your nametag near your right shoulder. If it's on a lanyard, shorten the lanyard so that people can actually see your nametag.
- There should be wifi at the conference, but hotel wifi is sometimes spotty.
- Conference days are very very long - it is acceptable to take a break when you need to.
- There will probably be alcohol at some of the events. Remember that you are representing your institution when you're at a professional meeting.
- The conference may have a social media policy. You can follow the conference hashtag if there is one and you're on twitter. Respect the stated norms on what can/cannot be tweeted (this varies by discipline and by meeting, especially when people are presenting unpublished work)

Conference Attire

Anna Ritz
Sep 20, 2018

Resolve

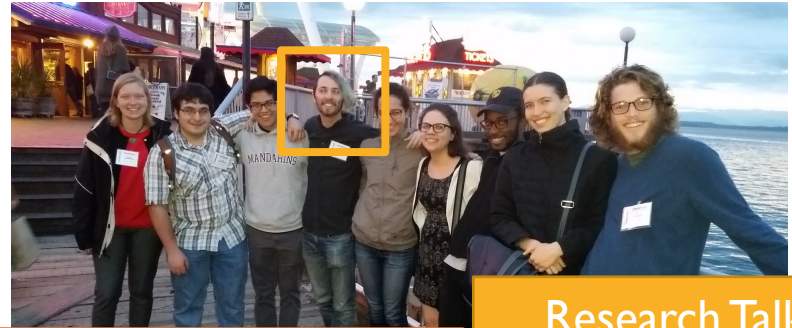
Additions are welcome to this doc! Use "Suggesting" mode in upper right corner so track changes are on.

This and all other links will be available on my website within a few weeks.

CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

Why did we do this?

- Scientific Conferences
- Integration in a Course



Research Talk
(Networks II on
Wed AM)

Postdoc Position
Available



CCF #1643361
(2016-2017)

How was it implemented?

- The Institution & Course
- The Conference
- Student Experiences



DBI #1750981
(2018-2023)

What's next?

- Local & National Initiatives

RELEVANT REFERENCES

- [Davis 2015] S. N. Davis, D. Mahatmya, P.W. Garner, and R. M. Jones. Mentoring undergraduate scholars: A pathway to interdisciplinary research? *Mentoring & Tutoring: Partnership in Learning*, pages 1–14, 2015.
- [Seymour 2004] E. Seymour, A-B. Hunter, S. L. Laursen, and T. DeAntoni. Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science education*, 88(4):493–534, 2004.
- [Auchincloss 2014] L. C. Auchincloss, S. L. Laursen, J. L. Branchaw, and others. Assessment of course-based undergraduate research experiences: a meeting report. *CBE Life Sci Educ*, 13(1):29–40, 2014.
- [Lopatto 2008] D. Lopatto, C. Alvarez, D. Barnard, and others. Genomics education partnership. *Science*, 322(5902):684–685, 2008.

CURE/SURE surveys:

<https://www.grinnell.edu/academics/resources/ctl/assessment/cure-survey>

(PDF forms of surveys available, comparison to background data no longer available)