11

SCIENCE COMMUNICATION TRAINING

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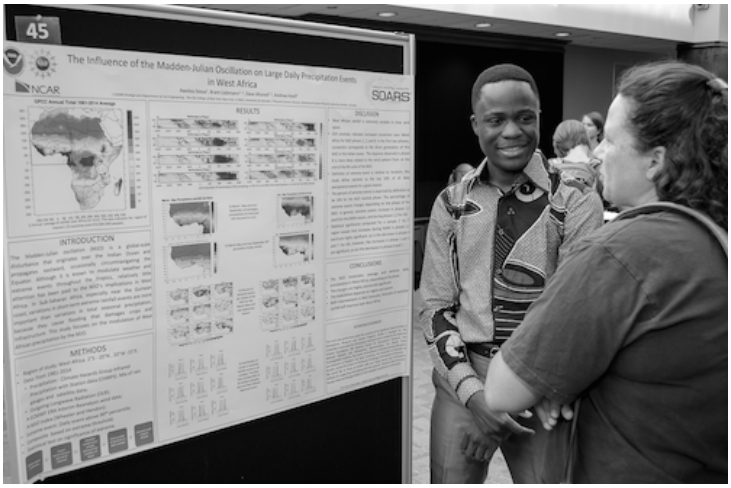
The GEO REU community generally aims to provide undergraduate students with training in communicating their science, in addition to providing mentoring, cohort-building activities, and an authentic research experience. Our hope is that this chapter will offer a menu of ideas and strategies on models, materials, and expectations to support your efforts in training young scientists in their writing and presentation skills.

Introduction

Graduate schools and employers sometimes comment that college graduates have shortcomings in their writing and presentation skills. An important component of the REU internship is to provide experience and training in communicating science clearly to different audiences.



Deliverables and Timeline of Deliverables

In identifying deliverables for your REU students, consider the following:

- Which scientific communication skills and deliverables will best prepare undergraduates for their future educational and career pathways? Options include a scientific poster, an oral presentation, a research paper, a proposal, a blog, podcast, or newspaper article. Increasingly, presentations are being given via video conferences.
- Are you proposing that your students will attend a conference? Will they develop an abstract and poster that they can use for that conference?
- What skills do they already have? Don't depend on their university to teach scientific writing or presentation skills.
- How can you break up deliverables into small milestones throughout the REU program that students can feel proud of, and that build towards the final deliverables of the program?

Menu of Scientific Communication Deliverables

Think of deliverables as landmarks and final goals for students to achieve. Consider these small and final deliverables for your REU program:

Small deliverables	***Final deliverables***
An elevator speech	A scientific poster and presentation
A two-page proposal with references	An oral presentation or a lightning talk
A research abstract	A paper or report (e.g., 5-page)
An online blog (biweekly, monthly)	An article to post on LinkedIn
Sections of a report/paper	A podcast for a general audience
	Abstract submission to a conference

Provide Students and Mentors with Guidelines

- » Have students get regular feedback from their research mentors and from their peers.
- » Have common deadlines for the deliverables for students, as they bond over this work.
- » Make sure to announce deliverables and deadlines to students and mentors at the start of the program.
- » Be clear about expectations, for example, when drafts are due, when materials should be approved by mentors, and the final deadline for poster printing, for example.
- » Put events, deadlines, and milestones on a calendar and on a list and share it with students and mentors.

May 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
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31						

June 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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July 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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12	13	14	15	16	17	18
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Example list of deadlines

Week 1: Elevator speech
Week 2: Small annotated bibliography
Week 3: Research proposal
Week 4: Draft of abstract
Week 5: Practice research talk
Week 6: Break (4th of July)
Week 7: Finalize and submit abstract to conference
Week 8: Draft of poster, final deadline for poster printing, practice presentation
Week 9: Poster session

Begin with the End: Plan the Final Events

Having a poster session or a talk symposium? Planning the event in advance is key. Here is a to-do list for REU managers or administrators.

1. Choose the date and time of the session. Afternoons can be good for attracting local scientists.
2. Create a video-conferencing session/reserve a space for the poster or oral session.
3. For poster sessions, identify a method of hosting it online; if in-person, reserve or find poster boards and stands.
4. Plan other logistics (AV support for talks, push pins for posters, water & snacks, etc.).
5. Communicate this deadline to interns and mentors at the start of the program.
6. Convey that family and friends are welcome (and encouraged!) to come.
7. Recruit poster or talk reviewers a few weeks beforehand. If you have ten interns, get ten judges and ask them to review three posters each. Provide them with an evaluation form, aiming especially to collect positive and constructive feedback.
8. Advertise the poster session or talk symposium via email, social media, flyers, or word of mouth 2-3 weeks in advance. Let your organization's communications person or office know to cover the event via social media, if your organization has one.
9. Set a deadline for poster/presentation submission for digital poster review/printing of paper posters.
10. Give a role to prospective attendees by asking them to fill out a simple feedback form. This form could ask what the main message of the poster or talk was, two things they liked about the talk or poster, and two suggestions.
11. For a virtual poster session or talk symposium, consider what platform you'll use, having potential breakout rooms where guests can "stop in" and visit student posters, and a separate time for poster judges to meet with students.

➔ Models of Teaching Scientific Communication

Many REUs hold a weekly workshop to support scientific communication training. These meetings also provide an opportunity to check in regularly with the interns and to keep the dialogue going with them.

The models for training vary widely, from having more intensive sessions up front in the first week or two to having workshops spread throughout the program.

Some REUs interweave science communication workshops with career awareness and development workshops and short field trips as well.

Having these workshops can help build a student cohort, and can encourage students to support each other and work together to solve problems. These workshops offer relief to mentors by having students help each other before seeking help from mentors.

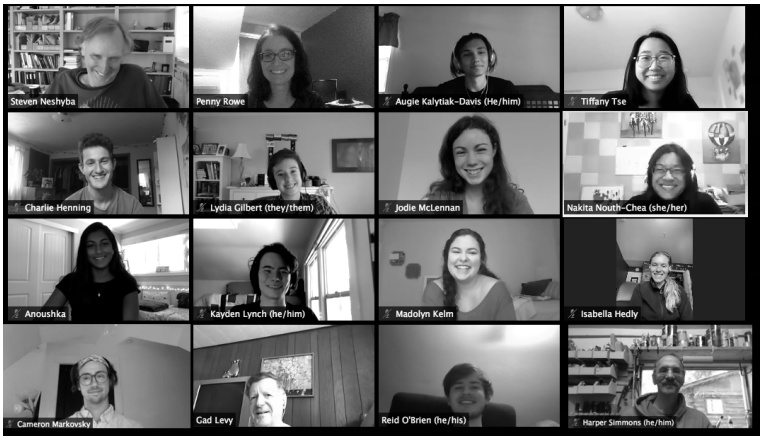
Here are a few models for workshops:

- » Regular weekly meetings of 1.5 - 2 hours including check-ins, workshops on communication, career and grad school panels, and virtual/real field trips.
- » Workshops on producing abstracts, posters, talks, or resumes.

The GEO REU community is active via the email listserv and is a great place to ask others what they have been doing for science communication in terms of deliverables and training. Ideas and program details constantly evolve, including modifications to programs that have moved online.

Virtual Programming

With the onset of COVID-19, many programs have moved online. A few successful models for online workshops have been adopted by REUs since the onset of the pandemic. Refer to the GEO-REU network website for some examples on transitioning online.



Panels: One model is to host virtual panels with professionals from different work sectors, with graduate students, and with faculty discussing graduate school applications.

Hybrid workshops: Another model is to hold workshops with a blend of presentation time, discussion time, and work time, either individually or in small groups. It is important to have at least two presenters so that one can help with technical pieces and potentially co-present. Consider providing an opportunity for students to share or teach what they have learned or present with their group as a discussion period. A 1.5- to 2-hour period is recommended.

Guidance and Materials for Training

The GEO-REU network has a (growing) collection of resources and example activities for various methods of scientific communication on their website (https://ncar.ucar.edu/what-we-offer/education-outreach/faculty-resources/geo-reu-resource-center), including:

- An elevator speech
- A two-page proposal with references
- A research abstract
- A scientific poster
- An oral presentation or a lightning talk
- A paper or report (e.g., 5-page)
- An online blog (3x per summer, biweekly, etc.) for a general audience
- An article to post on LinkedIn
- A podcast for a lay audience
- Abstract submission to a conference, including online sessions like AGU's virtual student poster session.

Examples of this guidance are shown below for three formats.

Workshop Activity: How to Give an Elevator Speech

Every scientist needs a short speech to introduce themselves and their work at conferences or in interviews, and when talking to potential funders and collaborators. The following is a brief outline of this activity. For more details, see the full document online.

1. Introduce the topic

Discuss what students think an elevator speech is, how it should vary between audiences, and provide them with some guidance on it.

Recipe for an elevation speech
What is the topic (start with the big picture)?
Why is this important (make it relevant to the audience)?
How are you helping to solve this question?
Why is it important (again)?

2. Give students a few minutes to draft points

3. Break students into pairs or small breakout groups, with these instructions:

- Decide who is the speaker and who is the listener in the first round.
- Get a timer out and set it to 45 seconds.
- The speaker gives their pitch in 45 seconds.
- The listener gets two minutes to provide feedback, starting with the positive.
- Switch roles.

Resources on Elevator Speeches

Jill Hopke summarizes and shares resources and tips about creating an elevator pitch and science talks from presentations that she participated in back in February 2013. Hopke, J. 2013. Communicating Science: From the "Elevator Pitch" to Research Presentations. JillHopke.com. Accessed July 18, 2019.

Watch as Dr. Rafael Luna shares his elevator speech about his cancer research at Harvard University with postdoctoral students. Luna, R., 2013. Luna Scientific Storytelling Innovative Elevator Pitch on Cancer (2:39 min), Research at Harvard University 2013. YouTube.

Workshop Activity: How to Write a Research Abstract

This is a relatively simple but effective exercise in teaching students how to critically read and dissect a research abstract, write an abstract for someone else, and then write one for their own research. For more details, see the full description online.

Process:

1. Introducing the abstract
2. Group dissection of an abstract
3. Abstract dissection with a partner
4. Draft an abstract (see below for ideas)

Choose from the following activities:

» Writing an abstract from a published article: Provide students 40 min to read a short, published journal article with a partner, discuss the article, and write an abstract for it. After the time's up, allow students to read the article's abstract and talk about how their abstract compares.
  • Strassmann, J.E., 2017. Teaching Effectively and efficiently: abstract writing. Sociobiology. https://sociobiology.wordpress.com/2017/03/01/teaching-effectively-and-efficiently-abstract-writing/

» Writing for someone else: Ask students to interview a partner about their project. Now write a short abstract for their partner's project. Ask a couple of students to read theirs to the group.

» Writing your own abstract: Give the students 15 - 20 minutes to write their own abstract. You can give individual assistance. Once the time is up, have them show it to a partner and get feedback on it.

Conference submission

Now that students have an abstract, they can submit it to a conference or online conference (e.g., American Geophysical Union Virtual Showcase). Provide information on where and when to submit!

Resources on Writing Abstracts

Bastian, H., 2018. Building a great scientific abstract: a quick checklist. Plos Blogs: Absolutely Maybe. https://blogs.plos.org/absolutely-maybe/2018/06/06/building-a-great-scientific-abstract-a-

Jump, P., 2013. Unusual introduction to the abstract. Inside Higher Ed. https://www.insidehighered.com/news/2013/06/28/professors-use-personal-ads-teach-students-how-write-abstracts

How to write an abstract activity: Quite fun, and challenging, too. Strassmann, J.E., 2017. Teaching effectively and efficiently: Abstract writing. Sociobiology. https://sociobiology.wordpress.com/2017/03/01/teaching-effectively-and-efficiently-abstract-writing/

SERC activity on writing an abstract from an article. The student does it on their own. Musselman, Z. A., 2008. Writing abstracts. National Association for Geoscience Teachers. https://serc.carleton.edu/NAGTWorkshops/geomorph/activities/23370.html

Prothero, W. Question of the day: writing an abstract. National Association for Geoscience Teachers. Retrieved Aug. 1, 2020. https://serc.carleton.edu/introgeo/interactive/qotd/abstract.html

Strazdes, D. and Clarke, A., UC Davis Undergraduate Research Center. How to write an abstract for the undergraduate research, scholarship, and creative activities conference. https://urc.ucdavis.edu/how-write-abstract

Workshop Activity: How to Give a Scientific Talk

Most REU programs have students present their research at the end of the program and sometimes do a practice talk earlier on. Talks are a common way of presenting project results both in the workplace and in graduate school. This is likely becoming more true given the transition to a virtual workplace. Here we provide some guidance on doing a workshop with the students on preparing a talk. It is worth doing this several weeks before the presentation so as to ease the

students' minds and reduce anxiety around presenting. It can also help the student to clarify what their project is really about in a more concise way.

Timing:

This can be a ~90 minute workshop if you want students to come away with a rough draft of their presentation.

Materials:

How to give a bad talk (and prepare a good one) - PPT slides
How to give a bad talk (and prepare a good one) - Recorded video of a workshop (43:36)

Process:

1. Look through the slides and watch the video.
2. Modify the slides for your use if you are going to give the presentation. Otherwise, you can show the video to your students.
3. Have the students work on drafting a PPT presentation on their project for 45 minutes.
4. Bring people together and ask for volunteers to give a 3-5 minute presentation using their slides.
5. Have 3-4 people present.
6. Take photos or screenshots of them presenting and share the photos with their mentors.

Tips:

» This workshop can be done earlier in the internship than you might expect; in fact, students are relieved to get started on their presentation. Even if the students haven't done much research at all, this process can help them to think about their project.
» Hold a practice talk session a few days before the final presentations.
» Take photos or screenshots during their presentations.

Resources on Giving Presentations

How to Give an Awesome (PowerPoint) Presentation (Whiteboard Animation Explainer Video).

Fleming, N. 2018. How to give a great scientific talk - Expert presenters share advice on how to capture and hold the attention of a conference crowd. Nature. Dec. 19.

Larkin, M. 2015. How to give a dynamic scientific presentation. Elsevier. Retrieved Oct. 26, 2020.

Workshop Activity: How to Make a Scientific Poster

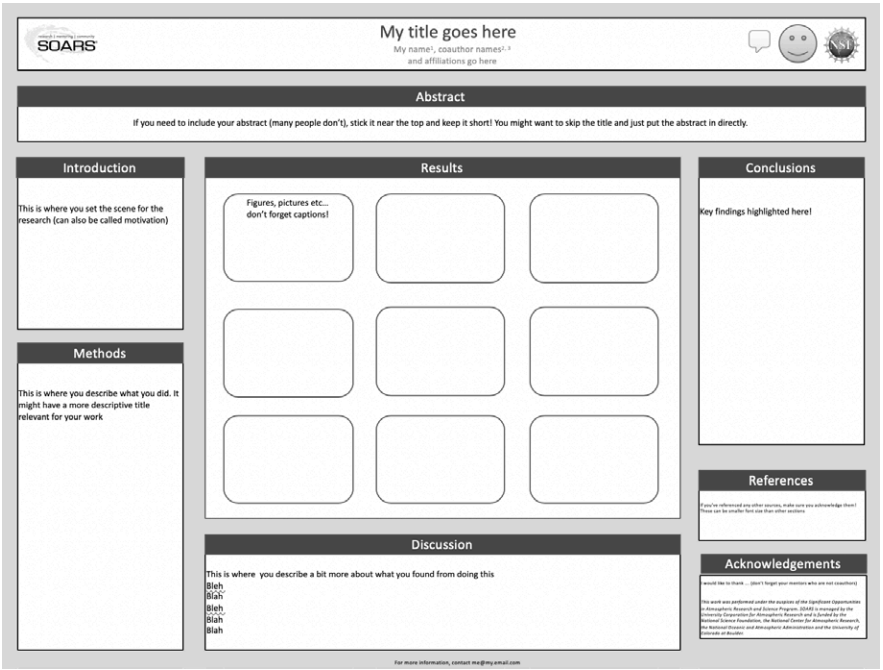
Poster sessions are commonly used at scientific meetings large and small, and the process of creating a poster can be truly daunting. By the end of this workshop, students will have made a serious inroad into creating their own poster. For more details, see the full document online.

Process:

1. Share the templates with students before the workshop.
2. Do a poster-critiquing activity with the students (15 min).
3. Outline the essential elements of a poster with the students' help (20 min).
4. Give student an hour to work on their own poster (1 hour).
5. Ask a few students to present their poster (15 min).
6. For a process to host a poster session online, see this guidance.

The Poster Template

The poster template can vary from a traditional layout, to new layouts where the title text is larger than usual and a QR code is added to direct people to their online poster. Starting with a traditional poster template can make the process of creating a poster less daunting. Stress that students can adjust boxes, layouts, fonts, backgrounds, etc. to suit their own research. It can also be helpful to pre-fill the poster template with necessary logos.



Poster creating activity - Asynchronous Activity

Provide students with a poster template such as one in Powerpoint, and suggest that they start by filling in the blanks of the template. This can be done with in-person workshops and online workshops. Make sure to provide available times when students can ask you questions, during this session and "office hours."

Resources on Making a Poster

Flaherty, C., 2019. #Betterposter. Inside Higher Ed. https://www.insidehighered.com/news/2019/06/24/theres-movement-better-scientific-posters-are-they-really-better

Johnson, N., 2014. How to create a poster in powerpoint. YouTube. https://www.youtube.com/watch?v=1c9Kd_mUFDM

Morison, M., 2019. How to create a better research poster in less time (including templates) #betterposter part 1. YouTube. https://www.youtube.com/watch?v=1RwJbhkCA58

Slides from an intern workshop at the National Center for Atmospheric Research.

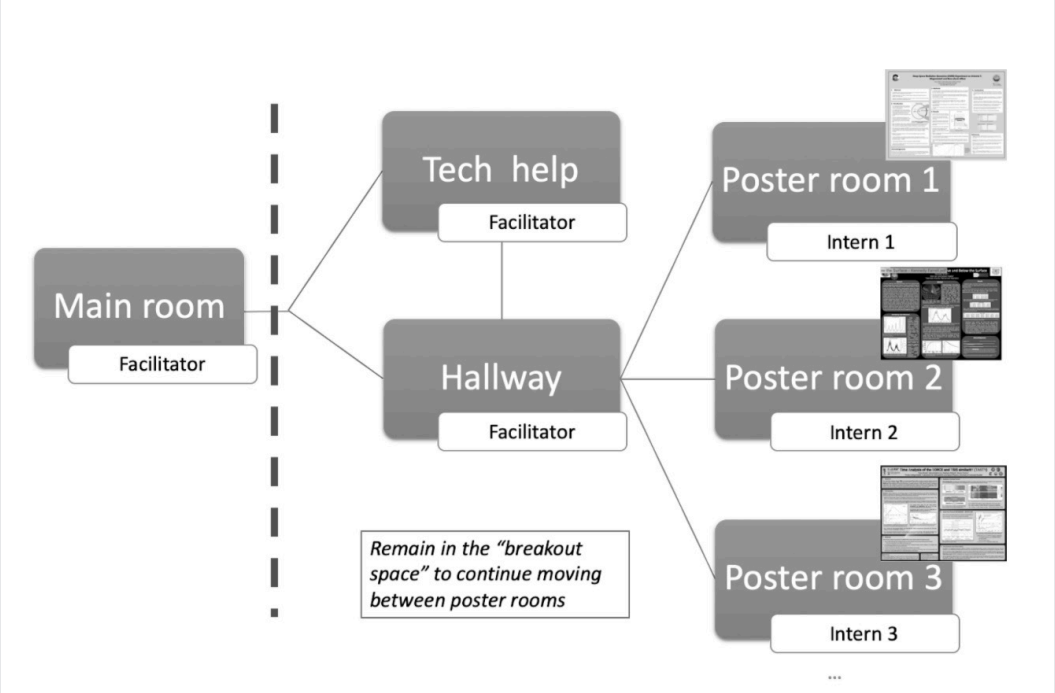
Swedberg, T., 2014. Research Posters. YouTube. https://www.youtube.com/watch?v=_UylugmaCHk

Virtual Poster Sessions

It is possible to hold these Our REU program's virtual poster session was on Friday, and it was a great success. We were able to simulate an in-person poster session for 24 presenters. A document describing how we set it up is found here.

We put each poster presenter in their own breakout room. The main obstacle is that people on Zoom cannot freely move from the main room to the breakout room of their choice. By creating a "hallway" breakout room and assigning all the visitors to it, people then had the ability to move from one breakout to another. They could see which students had no visitors and self-assign to that room. We had about 60 people circulating around the posters at one point, and it all went smoothly.

- Martin Snow, LASP, University of Colorado at Boulder.



Further Reading

Crowe, D., 2019. Visual and User Experience (UX) design principles can improve the effectiveness of poster sessions. DerekCrowe.net. https://derekcrowe.net/butterposter. Visual and User Experience (UX) design principles can improve the effectiveness of poster sessions.

Raftery, C., M. Snow, and Y. Zhu. 2020. Running a Scientific Poster Session over Zoom. White paper. National Solar Observatory and University of Colorado Boulder / LASP.