Getting Started in Broader Impacts: Overview of Considerations

CRS
COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

www.crscience.org

Identify Your Goals

What do you want to share about your science/engineering/research?

What would you like the broader public to understand?

What needs do you hope to meet? (diversity, public understanding, etc)

Do you hope to engage students, teachers, or the public in your research (citizen science, action projects, etc.)?

Finding Your Audience: What are their Needs?

Students: Pre K-12, Undergrads

- Build interest & identity
- Connect with role models & mentors
- Strengthen preparation
- Highlight pathways into research & STEM careers

Teachers: Pre-K-12, Community College, Afterschool

- Strengthen teaching, build science knowledge

General Public:

- Understanding of science & connections to daily life
- Greater trust of enterprise of science
- Support critical thinking, scientific literacy

Impact on teachers

- Strengthen science teaching skills, increase confidence
- Increase motivation = more time, higher quality science learning for children
- Engage in practices of science and engineering
- Discover the power of inquiry, hands-on learning to engage all types of learners

Being able to observe my students engaging with content, having scientific conversations, and interacting with the volunteers was truly incredibly helpful for my teaching practice. Thank you SO much!! *3rd Gr. teacher*

Impact on K-12 students

- Students engage in meaningful inquiry, authentic engineering, practices of science
- Kids meet inspiring role models & mentors
- Discover their own talents, skills, interests
- Learn about STEM careers and pathways into those careers
- Dispel myths of “who” can be a scientist

Students say:

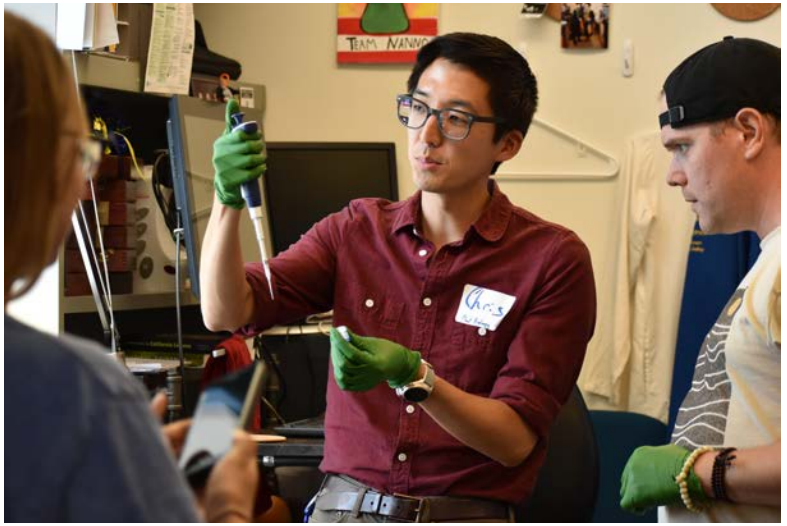
We became strong in our learning!

Science is cool!

Impact on Cal Scientists and Engineers

- Strengthen skills in communicating science concepts and information, share their research and why it matters
- Engage learners in active inquiry & critical thinking, strengthen teaching skills
- Social & emotional: Lab cohesion, coordination, collaboration, build community (and fun!)
- Share their pathways & serve as role models and mentors − sense of contributing to the community and impacting lives
- **Demonstrating skill in broader impacts for grants, 'beyond the bench' practical professional skills for future employment**

Impact on UC Berkeley



- **Grants – demonstrating broader impact, support early career, fellowships**
- **Develop skills of scientists and engineers in sharing their research and communicating about the nature of science and engineering, importance**
- **Builds community among campus cohorts (within labs, departments, across affinity groups); especially important for URM, women**
- **Connect campus with the broader community – visible, efficient, collaborative**
- **Contribute to scientific literacy, interest, value of science and engineering**

Impact on General Public

- Tap into curiosity & interest, current events, connections to community health & livelihoods
- Illustrating connections between research & “real world”
- Providing opportunities for engagement (citizen science, understanding data, connections to policy decisions)

Planning Outreach to Educators & K-12 schools: Determining Fit, Format, Topic

- Understanding the standards is important
- “Your” research is likely relevant at a few key grade levels, so develop variations for the different levels
- What time, resources, logistical support, funding, etc. do you have available?
- Looking for short- or long-term impact?

Examples of Types of K-12 Science Outreach – Different Goals, Formats

- **Classroom visits with hands-on activities**
- **In class mentoring**
- Afterschool programs & Family science nights
- Science fair judging & Career events
- “Festival” events
- Teacher PD

In what ways are scientific experts beneficial to educators and students?

- **Authentic experiences:** Understand standards, prepare teachers for success in meeting their educational goals
- **Build understanding** Focus on process, and the purpose of science – not just "dispensing facts"
- **Share** about the nature of your research (where do collaboration, communication fit in?) LOCAL connections
- **Invite participation**: Share ways teachers or kids could learn more about the topic (citizen science, good videos or books, local exhibits or experiences)

In what ways are scientific experts beneficial to educators and students?

- **Engagement**: Increasing teacher interest, understanding is key to getting them enthusiastic and confident to teach.
- **Inspiration**: Share about your own research, pathway, questions you are exploring, equipment/field research
- **Show, don't tell**: Dispel misperceptions – Research shows we cherry pick to confirm pre existing views; learners can't build "good new" understanding on a wobbly base.

Best practices for connecting with teachers & schools

- Understanding their needs and available resources
- Listening! Best learning is two-way!
- Tailor offering to fit within existing structures
- Identify ongoing connections to sustain engagement post-program
- Partnership can make outreach programs efficient & effective, leaving scientists to focus on science and partner to focus on logistics & training

Build Partnerships: What Role will You Play in a Larger Ongoing Network of Support?

- Campus resources
  - Existing in-school outreach programs in STEM
  - Teacher training programs
  - Student groups
  - Outreach or community partnership office
  - Public-facing institutions (museums, botanical gardens)
- Extracurricular programs, afterschool & summer
- Private industry partnerships
- Science centers, outdoor education

Preparing Scientists to be Effective Communicators in Classrooms & Teacher PD

- **Training is key** – match for audience and goals of outreach (CRS best practices resources online)
- As with any communication task, key questions for the presenter/speaker/writer: **who is my audience, and what is my key takeaway or goal**
- **No lecturing!** Be encouraging. Model uncertainty: 'That's a great question – I don't know. How could we find out?'
- How do you use the same tools/skills kids are learning? (**notebooks**, sketching, discussion/debate, supporting claims with evidence, **learning from failure**)

Examples from CRS Training Toolkit

- Choose your words – replace jargon with familiar language
- Use visuals
- Integrate your audience into the story – how does your topic touch their lives?
- Vocab comes in context, not front loaded. Kids feel empowered to learn new words.
- Goal isn't to build a vocab list – it's to tickle curiosity and demonstrate that it's possible to use scientific approach to systematically find answers, build understanding.

Role Model Intro: Be A Good Storyteller

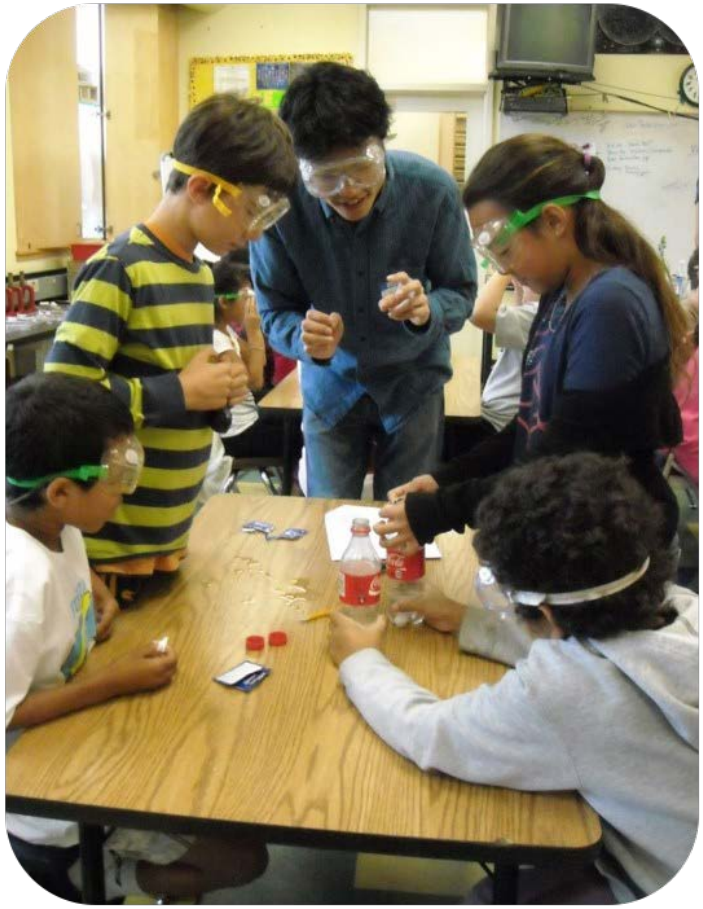
- Your personal “elevator pitch”
- Simplifying vs. dumbing down
- The take-away: why should kids relate?
  - How did you get into science?
  - What do you study?
  - How do you do your research?
  - How does your topic connect to kids’ everyday lives?
  - Does your topic have backyard impact?

Communicating Science In Schools

- Be adaptable: every school, grade, and student is different
  - Ask the teacher – good advance communication is important
  - Assess for learning – how will students show what they learn?
  - Use age-appropriate vocab, concepts, and metaphors
- Have a clear checklist of pre-outreach tasks
- Have a clear materials management strategy
- Teams are effective when possible (sustainability)
- Encourage participation
  - Keep it interactive
  - Say, write, show
- Have fun!

Developing Your Outreach Activity

- What is your phenomenon?
- How will you “hook” student interest?
- Simplify, simplify, simplify
- What is the one big question?
- Hands-on, active learning, interactive
- Use visuals
- Carefully consider logistics, materials
- Be a role model
- Have fun!

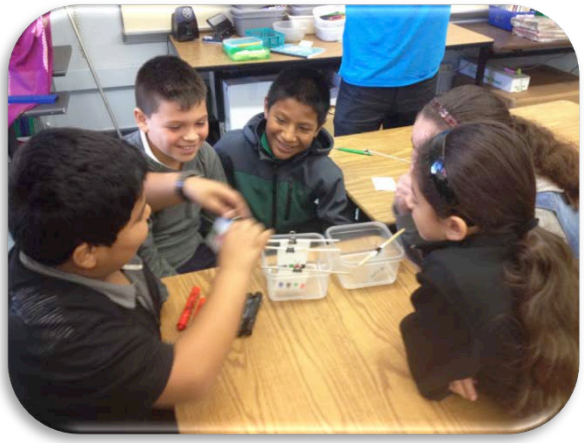


Developing a lesson: Template

Introduce yourself (elevator pitch)

Engage! Introduce your topic

- Phenomenon
- What do students already know?
- What background information do they need?



Explore! Facilitate a hands-on activity

- Investigations / Experiments / Games / Citizen science

Explain! Guide students to figure something out

- Be clear about WHY students are doing each aspect of the activity

Evaluate! How will students show what they learned?

- Wrap-up with real world connections
- **Why should students care?**

http://www.crscience.org/lessonplans/BASIS_LessonTemplate.docx

Special considerations for elementary

Clear communication about expectations, roles in advance is key

- Do you need the class divided for station rotations?
- A water source?
- Are there any special needs in the classroom you should be aware of
- Role of teacher during visit?

Content is interesting, but addressing equity & inclusion is critical at early age

- Focus outreach where it is needed most
- Be welcoming, encouraging all kids to discover connections to their interests and talents
- Emphasize ways that you collaborate, communicate, work with others in teams, and have fun

Share about pathways into science

- in the rearview everything looks linear and predetermined.
- It helps kids to understand that it's not that way moving forward in your life!

Teachers often lack training, comfort with science

- So much of education is driven by testing: having the "right answer"
- Teachers need to see that science is about figuring out when there isn't a "right answer" in the back of a book
- Share times that your own research didn't go as planned