STEM Outreach Collaboration Toolbox

A practical guide for partnerships between scientists and educators. This step-by-step guide provides tools to align thinking with action to plan, deliver, and reflect on youth STEM programming.

ARIS

Advancing Research Impact in Society

Author Information

Sarah Olsen, PhD is a Research Associate at the Lawrence Hall of Science, University of California, Berkeley where she conducts research and evaluation of STEM education programs. Skolsen@berkeley.edu.

Natasha Wingerter is a fish biologist with the US Fish and Wildlife Service. Natasha_Wingerter@fws.gov.

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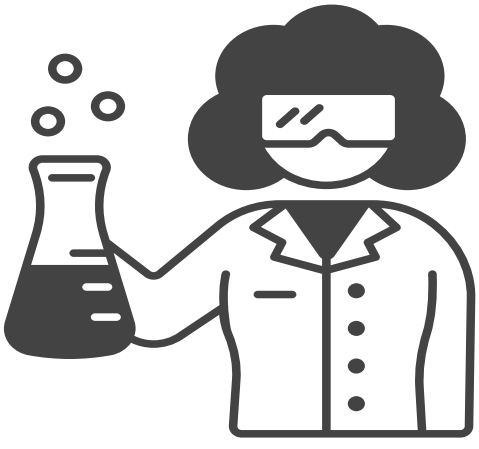
Introduction

Why **the toolbox can help you to successfully deliver a STEM educational outreach program.**

How **to use the toolbox for developing partnership norms, clarifying roles and responsibilities, and bridging disciplinary gaps while leveraging the expertise of each partner.**

Better Together



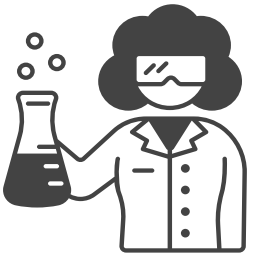
STEM Professionals
Scientists, researchers, technicians, graduate students interested in educational outreach

Education Programs
Organizations that aim to provide educational experiences for youth outside of school

Creating successful partnerships that benefit both sides is harder than one might think.
It takes time and planning.

This toolbox will help you through that process to make sure you make the most of each partners' expertise.

Why partner on a STEM outreach event?



STEM Professionals

A scientist has subject matter expertise and social capital with learners, providing a chance for learners to see what science looks like in action (and maybe even participate in it).

Educators

An educator/education program has expertise in designing, coordinating, and delivering learning experiences to meet the needs and abilities of learners and make learning engaging.

High-Impact STEM Outreach

- Provides an authentic and real-world STEM learning context for learners
- Supports learners to develop confidence in their science skills
- Increases representation of disadvantaged populations in STEM fields
- Meets grant requirements in a meaningful and impactful way
- Improves communication and public engagement skills
- Leverages the expertise of each partner:

The Plan

PHASE 1
Establish goals & mission

PHASE 2
Plan lesson(s) & objectives

PHASE 3
Develop teaching strategies

PHASE 4
Reflect & evaluate

The Tools

Agenda

- Pre-meeting prep
- Discussion points
- Action Items

Exercises

- Reflection
- Idea generation
- Articulating thoughts

Resources

- Timeline and roles
- Lesson planning
- Evaluation

PHASE 1

MY GOALS → OUR MISSION

- Reflect on your “Impact Identity”
- Align Goals, develop clear expectations and timeline
- Familiarize with student participants

Case Example

Valerie, a Movement Sciences faculty, collaborates with Eric, the coordinator of a College Prep program for first-generation college students.

Valerie and Eric met at a science colloquium on campus, where they discussed the possibility of bringing students into Valerie's lab to learn about her work investigating the application of Virtual Reality for certain health outcomes during the *College Prep* summer program, four months away.

Valerie was a first-generation college student herself and is excited to share her research with students like her but has never worked with high school students before. She feels a little overwhelmed with her teaching load already and is worried about the time investment.

Eric has been the College Prep coordinator for three years and is always looking for new faculty to work with so that students who participate in the program for all four years of high school are exposed to different types of fields and careers in STEM. He is excited about the potential collaboration, but often feels he must do a lot of the work of planning and preparing faculty like Valerie to participate in outreach, since they usually don't have training in this sort of thing.

Reflect

- *What are the strengths and motivations of each partner for collaborating on the STEM outreach event?*
- *How can Valerie and Eric determine whether they have sufficient goal alignment and capacity to plan the learning experience?*
- *How can Valerie and Eric clarify what is needed to successfully deliver the STEM outreach event?*

AGENDA MEETING 1

PHASE 1 SUMMARY

This phase explores each partner's goals and motivations in establishing this partnership. Together, the STEM partner and educator create a joint mission statement for this outreach. Finally, the partners clarify roles, responsibilities, and a timeline for collaboration.

ELEMENTS OF SUSTAINABLE PARTNERSHIPS

1. Trust and mutual respect
2. Adequate communication
3. Developing an action agenda
4. Respect for diversity
5. A culture of learning
6. Respect for the culture of the setting

PRE-MEETING PREPARATION

STEM Partner

❑ Complete Goals and Motivation (Exercise 1)

Educator

❑ Complete Goals and Motivation (Exercise 1)

MEETING CHECKLIST

❑ Determine if goals/expectations align well enough to continue program planning

❑ Create a program mission statement for your partnership, discussing your shared goals for this outreach endeavor (Exercise 2).

❑ Review the elements of sustainable partnerships to the left. Discuss what these statements mean to you. Do you both agree to follow these elements?

❑ Discuss the expected time commitment, describe goal population of students, establish a collaboration timeline and use the roles/responsibilities table to clarify roles/responsibilities.

❑ End meeting with a clear to-do list for next meeting

ACTION ITEMS

STEM Partner

❑

❑

Educator

❑

❑

Exercise 1

GOALS AND MOTIVATIONS

Directions: Write down your motivations for performing outreach. Discuss your motivations related to your partner's motivations to understand why your collaborator is interested in this project.

WHAT MOTIVATES YOU TO WORK WITH STUDENTS?

WHAT DO YOU HOPE TO GET OUT OF THIS EXPERIENCE PERSONALLY?

HOW DOES THIS FIT WITH YOUR PROFESSIONAL GOALS?

IMPACT IDENTITY

Risien and Storksdieck (2018) propose *Impact Identity* as a concept to support scientists in integrating their identities as researchers, communicators, citizens, educators, family members, etc. By strategically identifying the types of outreach activities that align with their skills, strengths, goals, and identities, a faculty/graduate student can foster the development of a lasting career legacy which integrates the needs of science and society.

[1]Risien, J., & Storksdieck, M. (2018). Unveiling impact identities: A path for connecting science and society. Integrative and comparative biology, 58(1), 58-66.

Exercise 1

GOALS AND MOTIVATIONS

Directions: Write down your motivations for performing outreach. Discuss your motivations related to your partner's motivations to understand why your collaborator is interested in this project.

HOW DOES THIS BENEFIT YOUR DISCIPLINE?

WHAT DO YOU HOPE STUDENTS WILL GET OUT OF IT?

LIST YOUR TOP 3 GOALS FOR THIS PROJECT.

1.

2.

3.

Exercise 2

OUR MISSION STATEMENT

Directions: Together, reflect on your goals for performing outreach. How do your goals align to your partner's goals? Brainstorm where your goals overlap to create your shared goals. Once you have established your shared goals, create a mission statement for your outreach collaboration.

WHAT ARE OUR SHARED GOALS?

1.

2.

3.

CREATING A MISSION STATEMENT

In 15-20 words, create a joint mission statement by filling in the blanks.

Our mission is to create _____(Verbs describing program activities)

_____(Program activity) for _____(Who)

_____(to What end).

Example terms:

Verb	Program activity	Who	To What end
Excite Engage Inform Activate Inspire	Programming robots Conducting air quality investigations	Youth in ___ program Learners in ____ grade __ grade Teachers	Inspire the next generation of programmers Increase the relevance of science to everyday life

Reflection: Does this mission inspire you? Do you see your work fitting into the mission statement? Does it accurately reflect the program? Does the mission statement reflect your values/the values of your organization?

RESOURCE

TIMELINE FOR COLLABORATION

Fill in dates as soon as is feasible and add these meetings to your digital calendars.

Phase	Timing	Purpose
	Three months before program (Date/time_____)	Reflect on your "Impact Identity" Align Goals, develop clear expectations and timeline Familiarize with student participants
	Two months before program (Date/time_____)	Reflect on your STEM story Brainstorm program ideas, objectives, and teaching strategies Lesson Planning Tools
	One month before program (Date/time_____)	Teaching strategies for students Finalize lesson plan, logistics planning, evaluation planning Create a media plan
Program (Date/time_____)		
	One week after program (Date/time_____)	Personal program reflection Team reflection and follow-up Analyze evaluation data Share your impact

STEM Professional		Educator
• Familiarize with program, implicit bias, privilege/power. • Develop strategy for engaging students in a non-classroom setting. • Produce authentic experience for program and prioritize what is important to share. • Develop your story and critically reflect on your role as ambassador. • Full commitment to this process.	During Planning	• Communicate information about students, be an advocate of student needs. • Share effective/appropriate teaching strategies. • Coordination of lesson plans • Solicit lesson plan feedback and format and technically translate STEM subject. Align with education standards/NGSS. • Activity planning forms and fiscal process. • Evaluation planning and implementation.
• Be a STEM ambassador and mentor • Be adaptive to student needs & interests • Provide positive support for students • Connect with students	During Program	• Manage student experience (behavior, any needs that arise) • Take photos • Managing time • Facilitate student reflection

Shared

• Co-facilitating program • Lesson plan development • Generate program goals and expectations • Create to-do lists, logistics planning (equipment, other resources)	• Share reflections • Write post-program brief, select photos. • Communicate • Assume 'positive intent' of partner • Celebrate success!

PHASE 2

PLANNING

- Reflect on your STEM story
- Brainstorm program ideas, objectives, and teaching strategies
- Lesson Planning Tools

Case Example

Valerie, a Movement Sciences faculty, collaborates with Eric, the coordinator of a College Prep Program for first-generation college students.

Valerie and Eric met to discuss the *College Prep* summer program. They now are clear on the tasks, responsibilities, and timeline for planning the outreach event. Valerie recruited her graduate assistants Monica and Brent to help her with the planning and instruction, and all four of them will be working as a team to develop the program.

Although Valerie and Eric were both first-generation college students, Monica and Brent come from families with high socio-economic backgrounds. They've never worked with youth from less economically advantaged backgrounds.

Valerie, Monica, and Brent are all enthusiastic to teach the program, but have yet to discuss any concrete ideas about what they want students to learn and be able to do by the end of the program. None of them are very familiar with high school science standards.

Reflect

- *Why should Valerie, Eric, Monica, and Brent discuss bias and privilege?*
- *How can Valerie, Eric, and the graduate assistants align their thinking about the objectives of the learning experience?*
- *What resources will they need to plan the lesson?*

AGENDA

MEETING 2

PHASE 2 SUMMARY

The second phase begins with centering the programming on the students by reframing the scientist's "elevator speech" to be easily communicated with outside audiences. Discuss strategies to support the students, recognizing places of privilege, and establishing a growth mindset. Once both partners are student-centered, program ideas are generated, explored, and translated into a lesson plan.

PROGRAM OBJECTIVES

PRE-MEETING PREPARATION

STEM Partner

❑ Complete Science Selfie (Exercise 3)

MEETING CHECKLIST

❑ Share reflections on Exercise 3

❑ Discuss how you will address bias and privilege (Exercise 4)

❑ Brainstorm overall program objectives and lesson plan (Exercise 5)

❑ Begin the nuts and bolts of lesson planning and logistics

❑ End meeting with a clear to-do list for next meeting

ACTION ITEMS

STEM Partner

❑

❑

Educator

❑ Complete Lesson Plan Part 1

❑

Exercise 3

Science Selfie

Directions: As a scientists, you are a social influencer. Use this sheet to reframe your elevator speech and dismantle stereotypes of how to become a scientist.

ELEVATOR SPEECH

HOW DID I GET INTO SCIENCE?

HOW DID YOU GET INTO YOUR RESEARCH AND WHY DO YOU THINK IT IS IMPORTANT?

WHAT WERE SOME FACILITATORS AND BARRIERS TO YOUR SCIENCE TRAJECTORY?

WHAT WERE SOME OF YOUR INSECURITIES WHEN YOU WERE DEVELOPING AS A STEM PERSON AND WHAT HELPED YOU PERSERVERE?

Exercise 3

Science Selfie

Directions: As a scientists, you are a social influencer. Use this sheet to reframe your elevator speech and dismantle stereotypes of how to become a scientist.

MODIFY YOUR ELEVATOR SPEECH TO EXPLAIN IT TO YOUR NEIGHBOR

WHAT MADE YOU A SCIENTIST?

WHAT HELPED YOU DEVELOP YOUR IDENTIY AS A STEM PERSON?

WHAT DO YOU THINK ARE SOME MISCONCEPTIONS ABOUT WHAT IT TAKES TO BE A STEM PERSON?

I'M MORE THAN A SCIENTIST...

WHAT ELSE INTERESTS YOU OUTSIDE OF SCIENCE?

EXERCISE 4

CHECKING OUR BIAS

Directions: Work together with your partner to have a discussion as to how you will address bias and privilege in your programming.

CONCERNS	CHECKING OUR BIAS
What are your concerns?	WHAT ARE SOME POTENTIAL BIASES YOU MIGHT HAVE TOWARD STUDENTS? WHAT ASPECTS OF PRIVILEGE MIGHT HINDER CONNECTIONS WITH STUDENTS? WHAT STRATEGIES WILL YOU EMPLOY TO CHECK YOUR CURRICULUM AND PROGRAMMING TO ADDRESS THESE ASPECTS OF BIAS AND PRIVILEGE TO SUPPORT THE STUDENTS? WHAT ARE SOME STRATEGIES TO ENSURE THE LEARNING MATERIAL IS RELEVANT TO THE STUDENT'S LIVED EXPERIENCES?

EXERCISE 5

MINDMAP TO A LESSON PLAN

In the past meeting you and your partner created a joint mission statement for your program. Copy your mission statement to the space below.

MISSION STATEMENT

Referring to your mission statement, create the objectives of your ideal program.

PROGRAM OBJECTIVES

1.

2.

3.

Now that you have centered yourself back to your original mission, in the space below, brainstorm ways to engage students in STEM. Try to think of a few once in a lifetime type of activities that you could do with your students. No idea is too big or too small.

BRAINSTORM OF ENGAGING STUDENT EXPERIENCES (use another page if needed)

Cross out any ideas that are not attainable and aligned with your program objectives. Pick your best three ideas to explore further.

EXERCISE 5

MINDMAP TO A LESSON PLAN

Once you have brainstormed lesson ideas as a team, you can begin elaborating on those ideas in a lesson plan. Using the following sheet, pick your best ideas from your brainstorm and expand this to explore these options as tangible activities.

IDEA 1	IDEA 2	IDEA 3

1) DEFINE THE PURPOSE

Consider the value of the activity and content. How it will enhance students' STEM learning, exposure to new STEM applications, or skill development?

2) IDENTIFY LEARNING OBJECTIVES

Learning objectives are brief statements that describe what students will be expected to learn by the end of the lesson. Finish the phrase "Students will be able to" to formulate the learning objectives.

3) CONNECT STANDARDS

Review the Three Dimensions of NGSS. Identify which practices, cross cutting concepts, and core ideas are relevant to this lesson.

4) STUDENT EXPERIENCE

Consider the characteristics of the students and how you will design the lesson to best support them.

5) WORK IT OUT

What materials and resources are needed? How much time is needed? Break down the activity into steps, estimating how long each will take.

6) PLAN FOR ASSESSMENT

How will you know if the objectives have been achieved? How will students show their learning? How will understanding of the concepts/standards be assessed?

EXERCISE 5

MINDMAP TO A LESSON PLAN

DEFINE THE PURPOSE	LEARNING OBJECTIVES
	CONNECT STANDARDS
STUDENT EXPERIENCE	WORK IT OUT
ASSESSMENT	

RESOURCE

How is a lesson plan like a research study?

LESSON PLAN		RESEARCH STUDY
Rationale	Consider the value of the activity and content. How it will enhance students' STEM learning, exposure to new STEM applications, or skill development?	Research purpose
Objectives	Describe the desired results for students to have by the end of the unit. How will you know if the objectives have been achieved? Use the "Students will be able to" (SWBAT) format to formulate the learning objectives.	Study aims/objectives
Standards/NGSS	What are the specific content standards will be addressed?	Protocol/literature review
Materials	Include any informational texts and resources needed for this lesson. Assign a person responsible for providing the material.	Materials
Timeline	When is this lesson in relation to other activities and what is the overall time frame?	Timeline/sequence
Modification	How will you modify the lesson to ensure all students achieve success?	Adaptation of protocols
Steps	What will be done ahead of the lesson? Schedule: Describe what needs to happen for each part of the activity, along with a time estimate.	Methods
Assessment	How will students show their learning? How will understanding of the concepts/standards be assessed?	Results/Analysis
Evaluation	See STEM Access Evaluation Plan and Tools Documents for Additional Information.	Discussion

Lesson Plan (Title)	Created By

Rationale	Consider the value of the activity and content. How it will enhance students' STEM learning, exposure to new STEM applications, or skill development?
Learning Objectives	Learning objectives are brief statements that describe what students will be expected to learn by the end of the lesson. Use the "Students will be able to" (SWBAT) format to formulate the learning objectives.
Standards/ NGSS	Check out the Three Dimensions of the Next Generation Science Standards (p. 28) and identify the practices, cross cutting concepts, and core ideas addressed through this lesson.

Lesson Plan (Title) (Continued)	Created By

Materials	Include any informational texts and resources needed for this lesson. Assign a person responsible for providing the material.

Timeline	When is this lesson in relation to other activities and what is the overall time frame?

Additional Resource: Check out the 5E lesson plan model developed by Rodger Bybee and BSCS which includes five phases: Engage, Explore, Explain, Elaborate, and Evaluate. https://ngss.sdcoe.net/Evidence-Based-Practices/5E-Model-of-Instruction

NEXT GENERATION SCIENCE STANDARDS: 3D LEARNING[1]

1) Scientific and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

2) Crosscutting Concepts

1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

3) Disciplinary Core Ideas (more info at www.nextgenscience.org)

Physical Sciences
- PS1: Matter and its interactions
- PS2: Motion and stability: Forces and interactions
- PS3: Energy
- PS4: Waves and their applications in technologies for information transfer

Life Sciences
- LS1: From molecules to organisms: Structures and processes
- LS2: Ecosystems: Interactions, energy, and dynamics
- LS3: Heredity: Inheritance and variation of traits
- LS4: Biological evolution: Unity and diversity

Earth and Space Sciences
- ESS1: Earth's place in the universe
- ESS2: Earth's systems
- ESS3: Earth and human activity

Engineering, Technology, and Applications of Science
- ETS1: Engineering design
- ETS2: Links among engineering, technology, science, and society

[1]NGSS Lead States. (2013). *Next generation science standards: For states, by states*. Washington: The National Academies Press.

PHASE 3

IMPLEMENTATION

- Identify teaching strategies for students
- Finalize lesson plan, logistics planning, evaluation planning
- Create a media plan

Case Example

Valerie, a Movement Sciences faculty, collaborates with Eric, the coordinator of a College Prep Program for first-generation college students.

The team is now has some great ideas and objectives for what students will learn about the application of Virtual Reality for certain health outcomes during the *College Prep* summer program. Now they are ready to plan out the lesson.

Eric is acutely aware of the needs and strengths of the leaners, including the cultural assets they bring, and wants to discuss appropriate teaching strategies with the team.

Valerie is working on a research proposal for the National Science Foundation and is thinking about how she can build upon the the summer program for engaging students in her research the following summer as well.

Reflect

- *How can the team plan appropriate teaching strategies?*
- *How can the team learn from the program for possible future iterations?*
- *What resources will Valerie and Eric need to plan the lesson?*

AGENDA

MEETING 3

OUTREACH PRINCIPLES

The third phase supports the implementation of the outreach program. First, reevaluate the lesson plan for design improvements and to ensure inclusivity. Then, lay out logistics regarding each element of the lesson plan, create a method of evaluation/assessment of the program, and make a media plan. Please note the difference between research and evaluation – if there is intent to publish or conduct research, then review by the Internal Review Board of the home institution is likely required (but not covered here).

PREPARATIONS FOR DELIVERING PROGRAMMING

PRE-MEETING PREP

STEM Partner

❑

Educator

❑ Complete Lesson Plan Part 1

MEETING CHECKLIST

❑ Go over the lesson plan and final logistics planning (Exercise 6)

❑ Discuss how to plan for flexibility when things don't flow as expected, the needs of the students and successful strategies for working with theses students (Exercise 6)

❑ Complete Lesson Plan Part 2

❑ Plan for assessment/evaluation (getting input from researcher).

❑ Discuss media/press release

❑ End meeting with a clear to-do list for next meeting

ACTION ITEMS

STEM Partner

❑

Educator

❑ Finalize an assessment/evaluation plan

❑ Finalize the lesson plan and logistics

Exercise 7

TEACHING STRATEGIES

Work through your lesson plan to finalize logistics and assessment. This activity aims to consider aspects of your program that may have been forgotten.

PROGRAM OBJECTIVES	ENGAGING ACTIVITIES
List your program objectives.	The students will participate in the following engaging activities:
SUCCESS	**SET UP**
What do students need to know and do to be successful in those activities?	How will you set up the activity and the students for success?

Exercise 7

TEACHING STRATEGIES

WHAT ARE SOME WAYS YOU MIGHT ADJUST YOUR TYPICAL TEACHING STRATEGIES TO MEET THE NEEDS OF OUR STUDENTS?

HOW WILL YOU FACILITATE THE DEVELOPMENT OF STEM IDENTITY IN OUR STUDENTS?

WHAT WOULD YOU DO IF STUDENTS DID _____? (Educator and STEM Partner set up their own scenario and jointly find a solution.)

WHAT NEEDS FURTHER CLARIFICATION?

Modifications	
Students with cognitive disabilities	Examples: Providing a quiet workspace, one-on-one instruction, hands-on-learning, safety measures
Students with physical disabilities	Dependent on circumstances, see: https://www.adcet.edu.au/inclusive-teaching/specific-disabilities/physical-disability/
Gifted/talented students	For ideas see: https://www.education.udel.edu/wp-content/uploads/2013/01/GiftedStudents.pdf

Steps	
Preparation, prior to Day 1	What will be done ahead of the lesson? Who will do what?

Schedule	i.e. Day 1, 8:00 AM etc. Describe what needs to happen for each part of the activity, along with a time estimate and assignment of a facilitator.

Assessment
How will you know if the objectives have been achieved? How will students show their learning? How will understanding of the concepts/standards be assessed? For a generic rubric applicable to science research projects, see "Rubrics for science assessment": https://dpi.wi.gov/science/assessment/rubrics
Evaluation
See Evaluation Plan and Tools Documents for Additional Information.

RESOURCE Informal Science Teaching Resources

There are a number of excellent organizations that provide resources, trainings, and materials for the development of informal science education experiences. The list below is just a start!

- **Visit the Center for Advancement of Informal Science Education (CAISE) website https://www.informalscience.org/:**
    - CAISE works to build and advance the informal STEM education field by providing infrastructure, resources, and connectivity for educators, researchers, evaluators, and other interested stakeholders.
    - Access research briefs, guidance for developing projects, example lessons and programs, and assessment and evaluation.
    - The 2016 CAISE report provides STEM professionals with an overview of engagement and public participation in scientific research, and a short list of organizations and networks that have resources. https://www.informalscience.org/informal-stem-education-resources-outreach-engagement-and-broader-impacts
- **Visit the National Informal STEM Education Network (NISE) website** https://www.nisenet.org/educational-resources:
    - NISE provides materials and resources for public STEM education through a community of educators and scientists.
- **Consider taking a training to develop your outreach skills:**
    - The Role Models Matter training provided by Techbridge Girls supports role models in developing skills to engage girls from marginalized communities. https://www.techbridgegirls.org/what-we-do/capacity-building/role-models-matter/
    - If you are looking for more comprehensive support in planning, coaching, and resources, consider the Portal to the Public's workshops and services. Portal to the Public helps informal learning organizations utilize and train scientists and engineers to have meaningful conversations with publics around local STEM issues. https://popnet.instituteforlearninginnovation.org/
- **Consider reaching out to your local public science center.** You can search the Association of Science and Technology Centers (ASTC) website to find one near you. https://www.astc.org/impact-initiatives/public-engagement-in-science/

Assessment of learning will be specific to the topic of the program. Assessment may be based upon the learning objectives and can assess both knowledge and skills (sometimes called 3D assessment). According to the UW Institute for Science and Math Education, 3D assessment development can be broken down into five steps:

Step 1: Define what you will assess by analyzing learning standards/objectives and crafting learning claims.

Step 2: Brainstorm Possible Scenarios for Eliciting Student Understanding.

Step 3: Use Task Formats to Build Questions to Engage Students with the Scenario.

Step 4: Imagine the Range of Possible Student Responses to the Questions.

Step 5: Share, Review, and Revise.

Rubrics to Assess Learning

Developing a rubric and distributing it to students will also clarify how they can meet the learning objectives. Rubrics used this way can also allow students to score their own work. For more on rubrics, see "Rubrics for science assessment": https://dpi.wi.gov/science/assessment/rubrics

Student Project Evaluation

A student project may be assessed through a rubric or another type of assessment. An example rubric for student research projects is the Scientific Literacy Rubric developed by the Stanford Center for Assessment, Learning, and Equity in alignment with the NGSS. Another example assessment for student projects which assesses the scientific validity of student work can be found here: "Evaluation of Student Work" https://oerl.sri.com/instruments/cd/studproj/instr158.html

Evaluating Program Impact

Because you are devoting time to designing and implementing an outreach program, you have a vested interest in whether the program is making a difference, and if the participants have experienced success. Program evaluation plays an important role in understanding the differences our work is making. While there are many ways to evaluate a program, **impact evaluations** provide information about **what changed as a result of an intervention**, in this case the outreach program and the specific activities of the program. To support you in developing tools and measurements to assess impact of outreach programs, the following strategies will help you make sense of how to evaluate your program.

1. Work together to discuss potential program impacts capturing each of the levels of evaluation described below (if possible). Consider reporting requirements for grants as well as program objectives. Impacts should be in the spirit of your program goals, student experiences, as well as granting agencies.

Levels of Evaluation (Kirkpatrick, 1996[1])

Level 1 Reaction - How do students react to the experience? - Satisfaction, engagement, participation, enjoyment, etc.

Level 2 Learning - **What knowledge/skills/experience are gained?** Achievement of desired learning outcomes, content knowledge, other learning outcomes, skills development, etc.

Level 3 Behavior - How is learning transferred or applied? - Behavior change, change in worldview, change in intention, change in confidence, change in life goals, change in perceived abilities, change in self-perceptions, etc.

Level 4 Results - Was the primary goal of the program achieved?

2. Identify possible indicators of impacts. Indicators can tell us to what extent our program objectives have been met (e.g. outputs), what progress has been made (e.g. process), and whether the change we are interested in is happening (e.g. outcomes). Indicators can be qualitative or quantitative. One to three indicators per impact should be sufficient, but keep in mind the cost of gathering, analyzing, and reporting information (more guidance on identifying indicators of impacts at Better Evaluation[2])

3. Use these criteria developed by USAID[3] to select the "best" indicators. Ensure direct measurement of a result/impact if possible - proxy measurements may be used if necessary.

Objective - No ambiguity about what is being measured and what data are collected, general agreement of interpretation of results

Attributable - Can be plausibly linked to program activities

Practical - Data can be attained in a timely way at a reasonable cost

Adequate - Is it sufficient? If impact is multidimensional, multiple indicators are needed

Disaggregated (if necessary) - Meaning data can be broken down by groups to help identify differences of impact for specific groups.

4. Discuss whether and how you might collect data which captures *unintended* impacts. For example, through open-ended survey or interview questions you might ask something like, "What aspect of this program did you find to be most valuable? Least valuable?"

[1]Kirkpatrick, D. (1996). Revisiting Kirkpatrick's four-level-model. Training & Development, 1, 54-57.
[2]https://betterevaluation.org
[3]https://usaidlearninglab.org/library/selecting-performance-indicators

1. Forecast Potential Impacts What do I anticipate will change as a result of the program? Consider the desired results of the program. These may be based on pre-established program objectives.	2. Indicators What are meaningful measurements of the impact? Include definitions of the indicator.	3. Methods What data will be collected, how, and when? Consider quantitative (suitable for precise identification), and qualitative methods (suitable for complex impacts)	4. Level of Evaluation At which level am I evaluating the program?
Example: Students will develop their science identity as a result of the program	Examples: Number of students who demonstrate increased science identity (feeling like a science person). Number of students who can describe a time during the program when they felt like a science person	Quantitative Example: Baseline and post-program data will be collected using a Science Identity scale via qualtrics Qualitative Example: Post-program interview with question: Please describe a time during the program when you felt like a science person.	Example: Level 3, Behavior

RESOURCE Media Plan/Release

Public engagement is one of the core values of the land grant university mission. Capitalize on the opportunity to not only engage the students participating in your program, but the broader community through a press piece. Send your initial press pitch early (about a month out from the activity) and be sure to follow up after 4-5 days without a response.

Sample pitch to an editor

Subject: Interested? Students "try on" college by creating their own video game

Hello X,

While many high school students are sleeping in and playing video games on the couch, students in the University of Idaho's Upward Bound program are creating their own video game. They are working in the University's high-tech biomechanics lab to understand how characters move and turning that knowledge into gaming code. **We invite you to join us on XX (date) when the students are in the biomechanics lab at the University of Idaho.**

In addition to making a video game, during the **free** summer program the students will build a support network of peers and mentors, gain hands on experience in **STEM** fields, earn college credit, learn to navigate the college gauntlet, and experience **Disneyland** behind the scenes.

Let me know if you are interested in this story,
Name
Position
Phone contact
Email

Media Contacts			
		Print Media	
Station	Contact Information	Newspaper	Contact Information

Photo tips

1. Designate someone to take photos for each activity.
2. Take photos from behind the students while they are participating in the activity.
3. Take photos in a way students can not be recognized, or the photo does not refer to any individual student. This is especially important when photos are used for promotional purposes, social media, or the researcher's website.

Program

A place to write down information which may be needed during the program and a quick reflection of your program's success

DETAILS

PROGRAM

SCHEDULE

PROGRAM PLAN

DESIGNATED PHOTOGRAPHER

*Will upload pictures to a shared drive within 24 hours

CONTACT INFORMATION

DAY-OF-PROGRAM QUICK REFLECTION

WHAT WENT RIGHT?	WHAT COULD BE IMPROVED?

PHASE 4

WRAP UP

- Reflect on your own and as a team
- Team reflection and follow-up
- Share your impact

Case Example

Valerie, a Movement Sciences faculty, collaborates with Eric, the coordinator of a College Prep Program for first-generation college students.

The summer program is now complete and the student surveys are now in. Eric has a lot of great photos of the learning event (with legal approvals).

Eric is acutely aware of the needs and strengths of the learners, including the cultural assets they bring, and wants to discuss appropriate teaching strategies with the team.

Monica and Brent have some great ideas about how the program can be improved upon next summer.

Reflect

- *How should the team use the assessment and evaluation data from student surveys?*
- *How can the team capture their program reflections?*
- *How can the team implement their learning from the program for possible future iterations?*

AGENDA

MEETING 4

PHASE 4 SUMMARY

The fourth phase is a final reflection and follow-up on the outreach program. First share your day-of-program reflections and assessment and evaluation results. Revise the lesson plan accordingly if this program will be used again. Next, create the content needed for a media release. Finally, consider the next steps for this collaborative effort—be it publications, further collaboration efforts, sending out thank you cards, etc.—and determine any additional follow up plans. Don't forget to celebrate your successes!

PRE-MEETING PREPARATION

STEM Partner

- ❑ Complete Final Reflections (Exercise 7)

Educator

- ❑ Complete Final Reflections (Exercise 7)
- ❑ Complete assessment/evaluation

MEETING CHECKLIST

- ❑ Share day-of-program reflections and final reflections (Exercise 7)
- ❑ Share assessment/evaluation results
- ❑ Revise lesson plan based on reflections/evaluation
- ❑ Media release tasks
    - ❑ Write the follow-up brief
    - ❑ Select and share photos
    - ❑ Decide how brief and photos may be shared (for newsletter, publication, reporting, blog, social media, case-study)
- ❑ Determine follow-ups (if any)
- ❑ Celebrate success!

ACTION ITEMS

- ❑
- ❑
- ❑

Exercise 7

Final Reflection

Which of the activities do you think worked well?	
Which activities were least successful?	
What about the program would you change if you were to do the whole process over again?	
What did you learn or experience throughout this process of collaboration that has impacted your ideas about outreach?	
In what ways has this experience impacted your mindset toward your professional work?	
Think of a specific student or story which demonstrates the impact of the program.	