A Checklist for Effective STEM Outreach in a K-12 Classroom

Are you a basic scientist or medical professional interested in taking your love for science to local classrooms, but don't know where to start? Try this:

- ☐ **Form a group of volunteers.**
  Find (or form) a group interested in K-12 science outreach. Undergraduate, graduate, and medical students are often excited to share their love of science with others! If you have minimal background in K-12 education, it is strongly encouraged that you find someone who is trained in K-12 education methods and curriculum development. While not necessary, having someone with a background in education at the appropriate level is immensely helpful, and they may have materials or contacts already.

- ☐ **Set clear goals for your event.**
  Goals are unique from learning objectives (see next bullet) and answer the question, "**Why are we doing this?**" Common goals of science outreach events include:
  1. Teaching students about a science topic
  2. Exciting students about science
  3. Engaging students in science
  4. Providing teachers with resources
  5. Promoting your own institution, department, or field

  Understanding your goals is a critical first step in designing your outreach event. Without clear goals, you cannot determine whether or not your event was successful!

- ☐ **Determine your audience.**
  Most classroom outreach events last 45-50 minutes. Younger students don't sit well for that long. Hands-on activities and demonstrations will be more effective in keeping their attention. Your audience will also determine your classroom setting. Elementary schools will primarily be run in a traditional classroom, while more laboratory-like spaces may become available with older audiences.

- ☐ **Develop a lesson plan and learning objectives.**
  A detailed lesson plan, and *measurable* learning objectives will help you stay organized. Learning objectives answer the question "what should students learn during my event?" If possible, build your learning objectives to address one of the Next Generation Science Standards (www.nextgenscience.org). Careful planning of the lesson, matching activities to your learning objectives, will lead to an effective outreach event.

- ☐ **Develop assessments of goals.**
  To know whether or not your event was successful, your lesson plan should include outcomes assessment. Time is an important consideration when developing this assessment. Teachers and students have limited time and lengthy assessments are not likely to be completed carefully, if at all. Of course, it remains important that your assessment actually tests the success of your event, by measuring outcomes related to your goals. Use assessments to determine whether or not the event met your ***event goals***.

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Common forms of assessment include:

1. Demographics and head count
2. Pre/post quiz comparison
3. Pre/post attitudes survey
4. Post event survey
5. Standardized test scores

Note: *Some assessment forms will require Institutional Review Board (IRB) approval, and journals may require this if you plan to publish your work. Consult your local research ethics board before you begin.*

- ☐ **Contact local principals and/or science teachers.**
  Reach out to the principal before reaching out directly to teachers. Include your lesson plan when you reach out. Teachers have limited time in their curriculum for extra events. Seeing a carefully developed plan, particularly one that meets Next Generation Science Standards (www.nextgenscience.org), will make them more likely to participate.

- ☐ **Practice your activities.**
  A well-run event is critical to keeping students interested and engaged. Say the words, do the activities! Volunteers should perform all activities **before** the event, and consider what words they will use to describe them. If it appears you don't know what you are doing, students will stop paying attention. These events always get better with time, but you **cannot** walk into a classroom without a plan.

- ☐ **Have Fun!**
  If you aren't excited to be there, don't go. People engage with enthusiasm! Let students see how passionate you are about the science, and they will be excited by it too!

- ☐ **Evaluate each event.**
  Did the event meet your goals? If not, consider why, and adjust. This may mean adjusting the event, but it also may mean re-evaluating the event goals. Are the goals appropriate to the style of outreach event?

  Take notes as quickly as possible after the event. What went smoothly? What could be improved for next time? If possible, try to do this self-reflection within 24-hours of the event. Ask the teacher and other volunteers to do the same.

- ☐ **Repeat…**
  The first event will not go perfectly. Don't get discouraged! Get back out and do it again. Review and reflect on each event, then adjust!