



Classroom Teacher Preparation

Scientific Practices 1: Procedural Thinking

Please use the following to prepare for the next SfS lesson.

Description:

The ability to give and follow instructions is an important life and science skill. Students will experience this procedural thinking from the point of view of both creator and user. After a whole-class replicating a drawing demonstration, students will first create an object with building bricks and write clear how-to instructions for building. Students will then be challenged to use only the written directions of their partner to replicate an unseen structure. Students will then compare their completed designs, critique their partner's instructions, and reflect on their own.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

3rd-8th [Disclaimer: writing and penmanship skills are a significant part of this activity and so may be more difficult for certain classes. Use discretion]

- Write a procedure (using written steps and/or drawings) that will be replicated (and then follow their partner's procedure to replicate an object)
- Critique their own and their partner's procedures to identify what makes for good and poor instructions (i.e., identify pros and cons)

Science & Engineering Practice (SEP)

Obtaining, Evaluating, and Communicating Information

- (3rd-5th) Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts.
- (6th-8th) Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

Preparation:

This lesson is an introduction to the topic (although obviously students know what directions are, even if they don't always follow them).

Room Set Up for Activities:

Students will be working in pairs at their desks with space to place a small divider to prevent students from seeing each other's work. **We suggest** pairing up students of relatively equal attention-to-detail / motivation to avoid situations of Student A creating exquisitely detailed instructions and Student B writing: “It's a video game controller”.

Safety:

There are no safety concerns for this lesson.

Related Modules:

This lesson may be taught at the beginning of a unit on **Technology**. Modules include:

Technology 1: Binary Code, or How to Speak Computer – Students get their first taste of binary through a series of activities focusing on encoding and decoding.



It may also be taught as part of a sequence of related modules on **Scientific Skills**, along with:

Scientific Practices 2: The Observation Challenge – Students learn about quantitative vs. qualitative observations and then must use them to describe mystery objects for their classmates.

Scientific Practices 8: Experimental Design – Using a ruler drop procedure (testing reaction time) as a starting point, students will develop a testable hypothesis and design an experiment around it.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state:
www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson with the activity, “My Robotic Friends”. Students partner up with a classmate or friend to act as programmer and give their partner (the robot) instructions to stack a set of cups.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- Errors from failing to follow instructions (there is some adult language on here but many of the photos are student-appropriate is wishing to select some examples): <http://www.dailymail.co.uk/femail/article-3725089/You-one-job-Viral-photos-drastic-errors-people-failed-follow-simplest-instructions.html>
- Writing a procedure: https://www.mindtools.com/pages/article/newTMC_78.htm
- http://www.sciencebuddies.org/science-fair-projects/project_experimental_procedure.shtml
- The Lesson Extension is an adaptation of “My Robotic Friends”, by Thinkersmith: <http://csedweek.org/files/CSEDrobotics.pdf>
- Another cool activity from Thinkersmith, created for the Hour of Code initiative (This one teaches a more advanced programming concept, so it’s a good next step after the Extension’s My Robotic Friends): <http://code.org/files/ConditionalsHoC.pdf>
- More online activities: <http://www.codecademy.com>, <http://hourofcode.com/us>, <https://www.commonsemmedia.org/blog/cool-tools-to-help-kids-learn-to-code>