Classroom Teacher Preparation

Scientific Practices 5: Measurement & Estimation

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

Description:

Students will learn the difference between estimating and measuring. The difference between precision and accuracy will be explained. Class measurements will be plotted to demonstrate the importance of taking multiple measurements. Students will be taught that precision is largely a function of the measurement tool, and accuracy is a function of the user. Advanced students will be introduced to the concept of significant figures. This lesson is aimed at 4^{th} – 6^{th} graders, or students who are not familiar with measurements and estimations.

Lesson Objectives – SWBAT ("Students Will Be Able To…"):

3^{rd}-6^{th}

- Know the difference between estimation and measurement
- Know the difference between precision and accuracy
- Understand that accuracy is improved by making repeat measurements and taking an average
- Understand that precision is limited by the tool available; accuracy is limited by the user

Disciplinary Core Idea (DCI):

- No DCI applies

Science & Engineering Practice (SEP):

Using Mathematics and Computational Thinking

Preparation:

Students should have a basic idea of the size of a centimeter, how much space is occupied by 1 milliliter and 1 liter, and how heavy 1 kilogram feels. Student should also be familiar with the metric prefixes centi-, milli-, and kilo-.

Room Set Up for Activities:

Students will work at their desks or tables in small groups of 2-3. Group representatives will also be sent to large laminated posters to plot their data. Water will be used in this lesson, so it will be convenient to have access to a sink.

Safety:

There are no safety concerns with this lesson.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Scientific Skills**. Other modules in this sequence include:

Scientific Practices 1: Procedural Thinking – Students learn the importance of creating and following clear and ordered plans. They will try to replicate the creation of a classmate from written directions.

Scientific Practices 4: The Classification Challenge - Students classify objects based on their observations, and learn how different classification schemes influence their view of the objects/world.

Scientific Practices 8: Experimental Design - In this lesson, students will compare a poorly-defined scientific question with a well-defined question that can be tested by a simple controlled experiment.

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: http://www.sciencefromscientists.org/standards/

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

After Our Visit:

Extend this lesson by conducting a series of estimations (blind and calibrated) and measurements to test their accuracy and precision.

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:

WGBH Videos and Activities: The PBS educational site is a great, **free** resource for educators but you must create an account to use the materials. The first time you log in to the PBS Learning Media website you will be asked to create an account and provide an email and password. Once you have logged in, select "keep me logged in" to avoid having to repeat the process.

- The difference between counting and measuring: http://mass.pbslearningmedia.org/resource/ketae.ged.math.counmea/counting-and-measuring/
- Lesson plans on measurement: http://msp.ehe.osu.edu/wiki/index.php/MSP:MiddleSchoolPortal/Measurement_Sliced_and_Diced
- Measurement teacher activities: http://atlantis.coe.uh.edu/archive/math/math_lessons/mathles4/activities/activities/activiti.htm