Classroom Teacher Preparation

Scientific Practices 8: Experimental Design

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

Description:

Using a ruler drop procedure (testing reaction time) as a starting point, students will develop a testable hypothesis and design an experiment around it. Students will identify independent, dependent, and controlled variables and outline an experimental procedure. They will then critique another group's experimental design. If there is time, students may carry out the experiment in class.

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

6^{th}-8^{th}

- State a hypothesis that can be tested and design an experiment to test it
- Identify independent, dependent variables, and controlled variables

Disciplinary Core Idea (DCI)

LS1 From Molecules to Organisms: Structures and Processes – LS1.D Information Processing

- (6^{th}-8^{th}) Each sense receptor responds to different inputs, transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behavior or memories.

Science & Engineering Practice (SEP)

Asking Questions and Defining Problems

- (6^{th}-8^{th}) Ask questions that require sufficient and appropriate empirical evidence to answer

Planning and Carrying Out Investigations

- (6^{th}-8^{th}) Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim

Crosscutting Concept (CCC)

Cause and Effect

- (6^{th}-8^{th}) Cause and effect relationships may be used to predict phenomena in natural or designed systems

Preparation:

This can be an introductory lesson or a review.

Room Set Up for Activities:

Students will work in pairs at their desks.

Safety:

There are no safety concerns.

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 2: The Observation Challenge – Students learn how to distinguish between subjective vs. objective observations and between quantitative vs. qualitative observations. They will understand that developing observational skills is crucial to becoming a scientist.

Scientific Practices 5: Measurement & Estimation – 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.

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 by conducting an experiment on how to blow the best bubbles.

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.

- Designing Experiments video (11:11): http://mass.pbslearningmedia.org/resource/a830e777-bb48-41ba-84b8-4bf385c49cb3/designing-experiments-against-all-odds-unit-15/

Other resources:

- *"Just a Theory": 7 Misused Science Words* by Tia Ghose, https://www.scientificamerican.com/article/just-a-theory-7-misused-science-words/
- *When is a Hypothesis Not an Educated Guess* by Baxter and Kurtz, https://learningcenter.nsta.org/resource/default.aspx?id=10.2505/4/sc01_038_07_18
- They Might Be Giants - Put it to the test! (1:57): https://www.youtube.com/watch?v=9kf51FpBuXQ