



## **Classroom Teacher Preparation**

### **Scientific Practices 12: Normal Distribution in Measurements (with Plinko!)**

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

#### **Description:**

This lesson provides a conceptual introduction to the normal distribution, its occurrence in nature, manufacturing, and scientific measurements, and its usefulness in analyzing data to minimize the effect of random errors. Students generate simulated data sets with approximately normally-distributed error, exchange them with each other, make histograms with the data, and analyze it to find the central value. Analysis may be visual, numerical, or both.

#### **Lesson Objectives – SWBAT (“Students Will Be Able To…”):**

**6<sup>th</sup> - 8<sup>th</sup>**

- Recognize the normal (or Gaussian) distribution is an important, and very common, distribution of observed and measured phenomena in nature
- Understand that random errors in measurement are normally distributed
- Describe the effect of a larger number of measurements on the accuracy of an experimental result

#### **Disciplinary Core Idea (DCI):**

- No DCI applies

#### **Science & Engineering Practice (SEP):**

*Analyzing and Interpreting Data*

#### **Preparation:**

It is very helpful for this lesson if the students are familiar with the concept of an average, and know how to calculate one.

#### **Room Set Up for Activities:**

Students will work in pairs first to generate their simulated data, and then in sets of two pairs to exchange and analyze the data. The activities can be performed at the students' desks.

#### **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 practices**, or as part of an introduction to doing a **science fair project**. Modules include:

*Scientific Practices 5: Measurement and Estimation* – This module walks students through estimating and then measuring the quantities of length, mass, and volume.

*Scientific Practices 8: Experimental Design* – This module introduces students to the criteria necessary for a good science experiment.



*Scientific Practices 11: Mean, Median, and Mode* – In this lesson students explore different ways to analyze data including calculating the central tendencies of mean, median, and mode. Students will focus on correlating their data to real world applications.

For other module sequences and groups, look here: [www.sciencefromscientists.org/sequences](http://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 looking for other occurrences of the normal distribution in the world around them with a Normal Distribution Scavenger Hunt.*

Access this Extension activity by visiting the Classroom Post found on our website at [sciencefromscientists.org/cohorts](http://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](http://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](http://www.pbslearningmedia.org) 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.

- A real-life application of statistics and the normal distribution, in a study of migratory birds (12:08)  
<http://mass.pbslearningmedia.org/resource/6c025afa-50b0-46a6-90b8-6dd0dff21d35/normal-curves-against-all-odds-unit-7/>
- The activities in our lesson are just one small part of the world of data analysis. There’s a lot more here:  
<http://www.mathsisfun.com/data/index.html>