Activity: Write It, Do It

Grade Levels: 3-5

Next Gen Science Standards:

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Common Core State Standards:

CCSS.ELA-LITERACY.W.5.2
Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
CCSS.ELA-LITERACY.RI.5.1
Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Overview of Activity:

Students will understand the importance of creating and/or following explicit instructions for the construction of a paper airplane. This activity will promote the understanding that instructions for the design of a model must be clear and flawless in order for the outcome to represent the original intended design. Students will understand that tests are used to identify flaws and areas of difficulties in engineering designs.

Background Knowledge:

Suggested activities for the teacher to use in days ***prior*** to the *Write It, Do It* lesson.

- Writing Clear Directions- Partner Activity / "Writer" and "Doer "(see attachment A)
- Following Directions- Use one of the links provided below for practice and discussion of the importance of following directions.

Key Vocabulary:

Variable- an element, feature, or factor that is liable to vary or change.

Flaw- a mark, fault, or other imperfection that mars a substance or object.

Precise- exact, accurate, and careful about details.

Experiment- a scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate a known fact.

The Scientific Method- a method of procedure that has characterized natural science since the 17th century, consisting in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses.

Related Scientific Concepts:

Engineering Connection
Engineers often create small-size models of a new product to test the design. This is especially true with airplanes. Model testing tells engineers how a design responds to different air conditions and aircraft shapes, and lets her/him experiment with the control surfaces that are used to steer the aircraft. Using small models allows engineers to throw away a model that does not work, which makes much more sense than throwing away a full-size (large and expensive to build) aircraft that does not work.

The Scientific Method Connection
If students are not familiar with the Scientific Method, use the link provided below as an introduction or review of the key points.

It is crucial that science experiments be fair. This means that the conditions for the experiment are controlled and consistent. If the variables (the things that change) are not controlled or if the experiment does not relate directly to the question (hypothesis), then it is considered a flawed experiment.

One thing that scientists and students must control in their experiments is the use of standard terminology. This simply means that everyone uses the same vocabulary. For example, in this activity if the writer stated, "Make a crease in the middle of the paper," this would require the doing partner to understanding the meaning of the word *crease*. It would also be important that the writer use the word *crease* throughout the instructions rather than possibly using the word *fold* in its place.

Another key factor in making sure an experiment is fair is that the key elements in the experiment stay the same. Scientists select one variable and that is the only element of the experiment that will change. A simple example: If you wanted to find out which tires would allow a car to accelerate the fastest, it would be important that the tires be the only variable, or change. The other elements of the experiment- the car, the driver, the road conditions, etc.- would stay exactly the same, otherwise the experiment would be flawed. A fair experiment is one in which the outcomes will become predictable because only one variable is in place.

Math Connection-Extension Activity, "Fly It Like You *Mean* It"

Have students test their airplane after the first attempt at "Writing" and "Doing" and record the results on the attached worksheet. (attachment B) Have students complete a second time from beginning to end, test the 2nd airplane, record the results and find the ***average*** flight information for each. Optional: Have the doer give the writer feedback on specific of the directions that were confusing or unclear; or have students swap roles as "writer" and "doer".

Use the questions in the Classroom Discussion Extension Activity Section to compare and contrast the airplane models.

Informational Links Pertaining to Standard(s):

The Scientific Method Made Simple
Read why the scientific method is critical in the areas of design and engineering. This explanation helps the teacher, and as a result, the students understand that there is no "failure" in an experiment gone wrong, rather knowledge is gained on what works or does not work.

http://www.sciencemadesimple.com/scientific_method.html

Steps in a Process Instruction
Use this blank template to provide practice on how to sequence the steps of a process
http://www.studenthandouts.com/1batch/graphic-organizers/10-process-steps.pdf
Also included as Attachment C.

Video Engagement for Students:

Science Experiments Gone Wrong- why scientists follow directions
https://www.youtube.com/watch?v=1lqnDNIz1kc

Following directions with Goofy- a silly but very informative video.
https://www.youtube.com/watch?v=6HHMT4M82_g

Song/Movement Activity, Following Directions
https://www.youtube.com/watch?v=Qr9ge4XGUYs

Interactive Links:

Read the instructions carefully and give directions in the correct order.
http://www.funenglishgames.com/readinggames/directions.html

Follow written directions activity
http://blogs.scholastic.com/files/followdirection.pdf

Following Directions Follies
http://www.educationworld.com/a_lesson/03/lp319-02.shtml

Class Discussion:

1. Writers, did your partner have trouble following your directions? Explain.

2. Doers, what was your reaction when you saw your airplane compared to the original design?

3. If you were asked to complete this activity again, what would you do differently? The same?

4. Make a list of clear, exact, or precise words that could be used to improve written instructions for making this airplane. What do you notice about these words?

5. Why is it important for scientists in the real world to use clear instructions?

6. Why is it important for scientists in the real world to follow the exact instructions?

7. Can you think of a time in your life when you were asked to do something, but did not have clear instructions? How did you handle that situation?

Writing Extension Activity:

Next year, another group of students will be asked to complete this same activity. Using what you have learned, write a letter to these students offering them advice or helpful tips for being successful writers and doers.