ATLANTA SCIENCE FESTIVAL

Lesson Title	Engineering Seed Helicopters
Grade Band	7th Grade
Submitted by	Donna Barrett, Metro RESA

Georgia Performance Standards:

S7L1. Students will investigate the diversity of living organisms and how they can be compared scientifically. .

b. Classify organisms based on physical characteristics using a dichotomous key of the six kingdom system (archaebacteria, eubacteria, protists, fungi, plants, and animals).

S7CS9. Students will investigate the features of the process of scientific inquiry.
Students will apply the following to inquiry learning practices:

a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing competing theories.

b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence.

c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant.

Safety Considerations:

Choose a safe place for students to drop their seed helicopters. Supervise students during the drop and remind them of the importance of being careful and safe. Use caution with scissors.

Materials & Time Required:

Materials:
Paper models of the seed types
Poster of seeds
Paper clips
Stopwatch
Samara seeds (if available)

Time: 3-4 days
Day 1: Introduction to the challenge (helicopter seed flight) and review plant classification; brief research on the seed types (some information can be found in the plant facts below
Day 2: Design an investigation using seed helicopter models to determine how various factors effect seed flight (adding weight (paperclips), using different shapes, modifying the shapes

(shortening the ears)
Day 3: Conducting the investigation, collecting data, reporting results
Day 4: Introduce the idea of biomimicry (see the link below to a Teach Engineering Lesson)

Lesson Logistics (for teacher):

Read the NSTA article in the resource link below. It will provide background information about maple seeds (samaras). It will provide ideas for experimenting with the seeds. The links from the Savannah River Ecology provide an activity to model the behavior of these seeds.

Stress to the students the importance of designing fair experiments. Use the template below for experiment planning and reporting. The template uses the C-E-R framework for students to make a claim/prediction about what they think will happen. Students should obtain background information about the seeds, seed dispersal prior to designing their investigations. The Savannah River Ecology lab has also provided details in the teacher materials below along with a student data sheet that could be used as an alternative.

Refer to the 4th grade lesson for another idea for an engineering challenge.

Opening: ENGAGE	**Engage** Show students the plant adaptations for flight poster (link in resources). Review plant classifications, particularly angiosperms and gymnosperms. Discuss the different types of seeds produced and focus on seeds that can be carried by wind and those that fly like helicopters. Introduce the students to the Helicopter templates and folding instructions (link in resources). Ask students to start thinking about how they could design a "fair" experiment with independent, dependent, and control variables. Have students conduct background research on the type of plants/seeds that will be tested.

Work Session: EXPLORE/EXPLAIN	**Explore** Design an investigation to determine how seed shape can effect its dispersal. Collect data. Complete the evidence (short statements from the data). Reasoning – connecting their evidence to their claim and how it supports or refutes the data.
Closing: EXTEND/EVALUATE	**Extend:** Explore the idea of biomimicry which includes developing products that are inspired by nature. The website, Teach engineering has an activity and more information at: https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_bio/cub_bio_lesson05_activity1.xml Airbus also highlights how birds has inspired their aircraft designs: http://www.airbus.com/innovation/eco-efficiency/design/biomimicry/ **Extend:** Get involved counting the spirals of sunflowers with the Citizen Science project: http://www.turingsunflowers.com/ The website provides information on how to count the spirals and report data to scientists looking to see if sunflowers grow in the Fibonacci Sequence. **Evaluate:** Use the included rubric to assess student work.

Documentation of Resources:

Helicopter template and folding instructions: http://srel.uga.edu/outreach/kidsdoscience/sci-method-copters/copter-designs.pdf

Group Data Sheet: http://srel.uga.edu/outreach/kidsdoscience/sci-method-copters/copter-student-data-sheet.pdf

Savannah River Lesson Plan: http://srel.uga.edu/outreach/kidsdoscience/sci-method-copters/copter-lesson-master.pdf

Fun Facts About Plants: http://srel.uga.edu/outreach/kidsdoscience/sci-method-copters/plant-facts.pdf

Plants Adaptations for Flight Poster: http://srel.uga.edu/outreach/kidsdoscience/sci-method-copters/plant-seed-poster.pdf

NSTA Journal Article: http://web.missouri.edu/hanuscind/8710/NSTA_MS_Hypotheses.pdf

Peacock, J. (2014). Evidence Based Writing. ***http://bit.ly/NEGAScienceMiddle***

Seed Experimental Investigation

<table>
<tr><td colspan="2">Question: What are you investigating during this experiment? Write your question in the form: What is the effect of --- on ---?</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Manipulated/ Independent Variable: the factor or group that is changed or compared in an experiment. Choose only 1</td><td></td></tr>
<tr><td>Dependent/Responding Variable: the factor that is measured in an experiment. How will you know if the change you made affects the results?</td><td></td></tr>
<tr><td>Constants/Controls: the factors in an experiment that remain the same in order to insure the experiment is fair</td><td></td></tr>
<tr><td>Procedure: Write a procedure to conduct the experiment, including:
How will you set up the experiment?
How will you drop the seeds?
How will you measure its performance?
How will you keep track of the data and determine if it is reliable?</td><td></td></tr>
<tr><td colspan="2">Claim/Prediction: (What do you think will happen during the experiment as a result of the factor you changed? You may write your statement in the form of – If --- is changed, then --- will be the effect.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Data: Create a data chart and graph to display your results.</td><td>Evidence: Choose evidence from your data that supports your claim. Find information from text (article or website) that helps support your claim.</td></tr>
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Reasoning: (This is the most important part of your answer. It provides your reader with the explanation for your claim, and it explains how your evidence supports or refutes your claim.

- The evidence shows:
- This experiment was fair because:
- I know (relevant disciplinary ideas – i.e., scientific facts and concepts such as adaptations, seed dispersal, plant characteristics, plant classification, seed types):
- I can apply (relevant crosscutting concepts – i.e., big ideas that connect the concepts and evidence such as *structure and function* or *patterns*):
- Therefore, I can conclude that:

Claim-Evidence-Reasoning Rubric

	4 Advanced	3 Proficient	2 Progressing	1 Beginning
Claim *A statement or conclusion that answers the original question or problem.*	• Makes a claim that is relevant, accurate, and complete. • Contrasts the claim to an alternative claim.	Makes a claim that is… • Relevant (Directly & clearly responds to question) • Accurate (Consistent with evidence and scientific principles) • Complete (Complete sentence that stands alone)	• Makes a relevant and accurate but incomplete claim.	• Does not make a claim, or makes an inaccurate or irrelevant claim.
Evidence *Scientific data that supports the claim. The data need to be appropriate and sufficient to support the claim.*	• Provides appropriate and sufficient evidence to support claim. • Discusses evidence that would support alternative claim.	Provides evidence to support the claim that is… • Appropriate (Scientific data or information from observations, investigations, data analysis, or valid scientific sources) • Sufficient (Enough evidence to support the claim)	• Provides appropriate, but insufficient evidence to support claim. May include some inappropriate evidence.	• Does not provide evidence, or only provides inappropriate evidence (Evidence that does not support claim).
Reasoning *A justification that connects the evidence to the claim. It shows why the data counts as evidence by using appropriate and sufficient scientific principles.*	• Provides reasoning that clearly connects the evidence to the claim. • Includes appropriate and sufficient scientific principles to explain why the evidence supports the claim. • Explains why the alternative claim is inaccurate.	Explanation provides reasoning that is… • Clear (Clearly communicated and goes beyond repeating claim and evidence) • Connected (Explains why the evidence is important or why it is relevant) • Integrated (Links the evidence to an important disciplinary idea and crosscutting concept)	• Provides reasoning that connects the evidence to the claim. May include some scientific principles or justification for why the evidence supports the claim, but not sufficient.	• Does not provide reasoning, or only provides inappropriate reasoning.

Developed by: Jeremy Peacock, Northeast Georgia RESA