NATIONAL MUSEUM OF THE UNITED STATES AIR FORCE™

Engineering Design Challenge – Straw Glider I

Students will have a basic understanding of the engineering process as they build, evaluate and modify a simple straw glider.

LESSON PLAN

Lesson Objective

The students will:

- Be introduced to the engineering process as they build evaluate and modify a straw glider.
- Learn to collect and analyze data as they modify the design.

Goal

In this lesson, students will work in teams and gain a basic understanding of the engineering design process.

The Engineering Design Process

This lesson plan uses the Engineering Design Process created by "Engineering is Elementary" which in turn was developed for the Museum of Science, Boston. No federal endorsement is implied. This Engineering Design Process has five steps and uses terms elementary students can understand.

WHAT IS THE GOAL?

ASK: What is the problem? How have others approached it? What are your constraints or limits?
IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.
PLAN: Draw a diagram. Make list of materials you will need.
CREATE: Follow your plan and create something. Test it out!
IMPROVE: What works? What doesn't? What could work better? Test it out!

It is important to note that the Engineering Design Process (EDP) is flexible. There are as many variations of the model as there are engineers and engineering teams. Since this is a cycle, there is no official starting or ending point. You can focus on one step, move back and forth between steps, work on one of two steps, then pass the project to another team or begin again to refine the glider.

Grade Level: 3 - 5

Ohio Learning Standards/Technology (2017)
Design and Technology

3-5.DT.1.b. Give examples of how requirements for a product can limit the design possibilities for that product.
3-5.DT.1.c. Describe a process as a series of actions and how it is used to produce a result.
3-5.DT.2.a. Critique needs and opportunities for designing solutions.
3-5.DT.2.b. Plan and implement a design process: identify a problem, think about ways to solve the problem, develop possible solutions, test, and evaluate solution(s), present a possible solution, and redesign to improve the solution.
3-5.DT.2.c. Generate, develop and communicate design ideas and decisions using appropriate terms and graphical representations.

Ohio Learning Standards/Science (2018)
Expectations for learning
Nature of Science

Physical Science
5.PS.1: Force and Motion

Ohio Learning Standards/Mathematics (2017)
Measurement and Data
4.MD.1: Express a larger measurement unit in terms of a smaller unit.
6.SP.5.c. Find the quantitative measures of center (median and/or mean)

Materials Required:

- Paper
- Card Stock
- Drinking straws—various sizes
- Tape
- Caution tape, string or some method to create a "fly zone"
- Safety glasses/Eye Protection
- Measuring Tape—tape down or secure in the designated fly zone

Step 1: Create a straw glider. Let the students conduct test flights in a designated "fly zone." Follow recommendations for safety in the classroom.

Step 2: Introduce the Engineering Design Process:

- **ASK:** What is the problem? How have others approached it? What are your constraints or limits?
- **IMAGINE:** What are some solutions? Brainstorm ideas. Choose the best one.
- **PLAN:** Draw a diagram. Make list of materials you will need.
- **CREATE:** Follow your plan and create something. Test it out!
- **IMPROVE:** What works? What doesn't? What could work better? Test it out!

Step 3: Organize the students into teams.

Step 4: ASK: What is the problem? Make a straw glider that can go farther.
How have others approached it?
What are your constraints? May only use the materials provided. (You may also want to include other materials not listed on page one such as paper clips, different weight papers, etc.)

Step 5: IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.
Encourage students to think "outside the box."

Step 6: PLAN: Draw a diagram. Make list of materials you will need.

Step 7: CREATE: Follow your plan and create something. Test it out!
Follow recommendations for safety in the classroom: create a designated fly zone, no one retrieves glider from the fly zone until the "Control Tower" (usually the teacher) gives an "all clear" and wear safety glasses.

Step 8: IMPROVE: What works? What doesn't? What could work better? Test it out!
Give students the option of three or more refinements to the design before a "fly-off" to determine the best design.

See student worksheet.

Resources:

Information on the Engineering Design Process:
https://stemactivitiesforkids.com/2016/02/22/the-engineering-design-process/
https://www.engineergirl.org/128119/engineering-design
https://www.nasa.gov/audience/foreducators/best/edp.html
https://www.teachengineering.org/k12engineering/designprocess
https://www.eie.org/overview/engineering-design-process

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STUDENT /TEAM WORKSHEET Name_____

Glider—Design 1

Design 1	Trial 1	Trial 2	Trial 3	Mean
Distance				

How will you change the straw glider to increase the distance flown?

Glider—Design 2

Design 2	Trial 1	Trial 2	Trial 3	Mean
Distance				

Did the change improve the distance flown? Yes or No

How will you change the straw glider to increase the distance flown?

Glider—Design 3

Design 3	Trial 1	Trial 2	Trial 3	Mean
Distance				

Did the change improve the distance flown? Yes or No

How could you change the straw glider to increase the distance flown?

Which design flew the best?