

Lesson Plan Template

Video Presentation Title: Fruit Fly Surveillance

Unit of Instruction: Unit 1 Design Process

Subject/Course: Project Lead the Way:
Introduction to Engineering Design

Overview & Purpose:

The video and education content provided will teach students about a current engineering project at NASA. Students will learn from a NASA engineer of the process the Fruit fly Lab engineering team took in designing a fruit fly observation system for current scientific research on the International Space Station. Students will learn of the need and the constraints and be asked to come up with their own design. The design used by the NASA engineers will then be explained and students will be asked to compare their designs. Students will then learn more about the NASA engineer and his educational and professional background and hear the advice he has for them in pursuing an Engineering career.

Resources Needed:

- Computer and projector to show video
- Internet access to stream video
- Design Document (Educator Guide & Student Template)
- KWL Chart (Educator Guide & Student Template)
- NASA Fact Sheet: Fruit Fly Lab

Next Generation Science Standards (NGSS):

HS. Engineering Design

- HS – ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ET S1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Common Core State Standards (CCSS):

ELA/Literacy

- RST.11-12.7: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Project Lead the Way (PLTW) Course Outline Knowledge & Skills:

Introduction to Engineering Design

Unit 1: Design Process

- Utilize research tools and resources (such as the internet; media centers; market research; professional journals; printed, electronic and multimedia resources; etc.) to gather and interpret information to develop an effective design brief.
- Define and justify a design problem, and express the concerns, needs, and desires of the primary stakeholders.
- Present and Justify design specifications, and clearly explain the criteria and constraints associated with a successful design solution.
- Write a design brief to communicate the problem, problem constraints, and solution criteria.
- Generate and document multiple ideas or solution paths to a problem through brainstorming.
- Clearly justify and validate a selected solution path.

	The teacher will:	The student will:
<p>Objectives <i>(Specify skills/information that will be learned)</i></p>	<ul style="list-style-type: none"> • Share and discuss learning objectives with students. • Use this Spark 101 Video and Education content to • Demonstrate current NASA engineering projects and associated scientific research • Introduce a real-world design challenge for students. • Reinforce the engineering design process • Discuss career paths in the field of Engineering and at NASA 	<ul style="list-style-type: none"> • Discuss learning objectives with classmates and teachers. • Learning Objectives: • Learn about engineering needed for surveillance of fruit flies in space from NASA subject matter experts • Utilize research tools to help develop an effect design brief. Specifically, students will research circadian cycles, types of camera lenses, and types of lighting. • Write a design brief for the fruit fly observation system. • Brainstorm multiple ideas for the design. • Select a design and justify the selection. • Compare and contrast the selected design to the one designed by NASA SMEs. • Learn about engineering career paths.
<p>Activator <i>(Prior to showing the video presentation)</i></p> <ul style="list-style-type: none"> • Read & Discuss NASA Fact Sheet: Fruit Fly Lab • Introduce Design Document 	<ul style="list-style-type: none"> • Read and Discuss the NASA Fact Sheet: Fruit Fly Lab, with your students. Answer any questions they might have and have them speculate about what kind of engineering is involved in the lab. • Introduce the Design Document to the students before watching the first segment of the video. Go through the engineering design process as outlined and answer any questions. Direct students to listen closely to the video to complete the design document. • Play the first segment of the video. 	<ul style="list-style-type: none"> • Read and discuss the NASA Fact Sheet: Fruit Fly Lab. Ask any questions related and speculate about what kind of engineering is involved in the lab. • Read over the Design Document and then watch the first segment of the video.
<p>Problem Solving Activity <i>(Describe process for identifying possible solution(s) to the problem presented)</i></p> <ul style="list-style-type: none"> • Work on Design Document • Research / K-W-L <p><i>Note: this activity will require some time to research on the internet. It will either require access to this in class or can be assigned as homework.</i></p>	<ul style="list-style-type: none"> • Direct students to complete parts A-E of the design document. <ul style="list-style-type: none"> ○ For part B, the constraints listed in the video are: <ul style="list-style-type: none"> ▪ Hardware must be sized to fit existing cassettes and pre-determined space on the ISS. ▪ Hardware must accommodate a camera for observation. ▪ Hardware must contain a light source for the camera that simulates a circadian cycle. ▪ Maintain temperature. 	<ul style="list-style-type: none"> • Complete the design document which will direct them in completing steps 1-6 of the engineering design process (from defining the problem to selecting an approach). • As part of the process students will use a K-W-L chart to brainstorm ideas and do further research.

	The teacher will:	The student will:
	<ul style="list-style-type: none"> ▪ Minimize power use. ▪ Hardware must be easy to install/uninstall for efficient use of crew time. ○ They will need the K-W-L templates for part C. • Further instructions for the teacher are given on both the Design Document Educator Guide and K-W-L Educator Guide. 	
<p>Checking for Understanding <i>(Steps to take along the way)</i></p>	<ul style="list-style-type: none"> • While students are working in groups, facilitate conversation and brainstorming as needed. • Play the second segment of the video • Direct students to complete part F of the Design Document. • Discuss with the class how their designs compared to the one developed by NASA scientists. • Answer any questions students may have. 	<ul style="list-style-type: none"> • Watch the second segment of the video. • Complete the Design Document • Discuss how the classes designs compared to the design developed by the NASA engineers.
<p>Summarizer</p> <ul style="list-style-type: none"> • Complete Design Document 	<ul style="list-style-type: none"> • Show the final segment of the video • Encourage student discussion on career paths • Have students discuss what their career goals are and paths that they might follow to achieve them • Answer questions students may have about career paths 	<ul style="list-style-type: none"> • Watch the final segment of the video • Discuss what career paths you may have that relate to the video and ask any questions you may have as a result of the video
<p>Additional Notes:</p> <ul style="list-style-type: none"> • Possible Extensions 	<ul style="list-style-type: none"> • NASA has many different engineering design challenges they run. There are different time frames involved in each. To find and participate in a current a NASA engineering design challenge, go to nasa.gov and search for engineering design challenges. • Encourage students to search for and apply for these opportunities as well. • The fruit fly lab will be flying different experiments over the next few years at least. Encourage students to research more about what scientists are seeking to learn from these experiments. • Talk to the biology teachers in your school to see if there are ways you can collaborate on this topic. 	<ul style="list-style-type: none"> • Search for engineering design challenges offered through NASA (at nasa.gov) and apply for ones in areas of interest. • Learn more about the science behind fruit fly research by searching online.