BIRDEE Unit 1 Lesson Plans

Unit 1 Module 2: Launcher Lotus Effect (Test a Solution)	Materials
Module 2 Overview: 1.2.1. Benchtop Prototyping 1.2.2. Testing the Lotus Effect 1.2.3. Conceptual Design 1.2.4. Design Review 1.2.5. EDPL	1.2.0. EDPL Map

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1.2.1. Benchtop Prototyping

Prototypes and models allow early testing of key design functionality. Students will create a benchtop prototype to test the efficacy of the Lotus Effect under different conditions.

Before the Lesson:
Teachers will need to prepare Paper Leaf samples (1 per student), half of which must be prepared with Neverwet the day before the lesson and allowed to dry overnight. Follow video instructions for safely using Neverwet: **Neverwet Video Instructions**.

Teachers will also need to gather materials to prepare for the test:

- **Samples:** felt, fabric, faux leather, denim, wood, metal, paint, plastic, cardboard, paper
- **Mounting materials (one per team):** Mounting base (file folder, scrap cardboard), small poster board, 1" painter's Tape, glue stick or low temp hot glue, stapler.
- **Testing Liquids (needed for the next lesson):** Water, Food-Colored Water/Dirt Water, Chocolate Syrup, coffee, hand sanitizer, packets of ketchup/mustard/soysauce

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Teacher Note: All the activities and videos below are embedded in the **1.2.1. Lotus Leaf PPT**, including today's BID WOW!

Engage: 15 min *(Guided experiment)*

View: **1.2.1. Lotus Leaf PPT**

- **Class Discussion:** What is special about a Lotus Leaf? Do you notice anything interesting in the images below?
- **Paper Lotus Leaf Experiment:** *(Student Pairs)*
  You will work in pairs to test treated and non treated paper leaf samples with a cup of water.
- **Class Discussion:** What is your reaction to what happens? Why do you think this happens?

Explain: 20 min *(Presentation and Class Discussion)*

The Lotus Effect
The Lotus Effect results from very small structures on the surface of the lotus leaf that make it a superhydrophobic surface that repels water.

- **Play video:** **Zoom into Lotus Leaf**
- Lotus Effect - how does it work?
- 3 features of the Lotus Effect
- How does it keep the plant clean?
- **Play video:** **Superhydrophobic Simulation**
- **Play video:** **Engineers bounce water**

Class Discussion:

- How can the Lotus Effect be helpful for our dirty shoes problem?

Student Handouts:

N/A

Student Materials:

Purchased paper leaves or **Paper Leaf Template**
(1 per student - 50% Prepped with Neverwet Clear Spray), Cups of water

Experiment Samples: (should be cut into 5 x 7" rectangles). May include felt, fabric, faux leather, denim, wood, metal, paint, plastic, cardboard, paper. Students may also bring in their own samples that relate to their design, but should be advised that they will likely get stained.

Mounting materials (one per team): Mounting base (file folder, scrap cardboard), small poster board, 1" painter's Tape, glue stick or low temp hot glue, stapler.

Testing Liquids: Water, Food-Colored Water/Dirt Water, Chocolate Syrup, coffee, hand sanitizer, packets of ketchup/mustard/soysauce

Instructional PPT's & Materials:

Neverwet Video Instructions

1.2.1. Lotus Leaf PPT

Teacher Resources:

N/A

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- ○ ***Teacher Note:*** *Neverwet is a coating that creates a superhydrophobic surface.*
- What else do we need to know about Neverwet if we want to use it for our dirty shoes problem?

Explain: 5 min *(Presentation)*

Benchtop Prototyping

- We can learn more about the lotus effect with benchtop prototyping. Benchtop prototyping tests a critical function of an idea before a complete prototype of the entire solution is made and tested.
- **View:** Catapult Image
- Benchtop prototyping will allow us to test Neverwet on different surfaces and fabrics to make sure it works before making a complete prototype.

Extend: 15 min *(Group)*

Now, we will prepare our samples for our benchtop prototyping test. Let's first learn how to properly and safely apply Neverwet.

Play video: Neverwet Experiment Video Instructions

Prepare Samples:
After watching the Neverwet Experiment Video, your group will do the following:

- Choose and assemble a mounting base (file folder, scrap cardboard or poster board). Write the names of all group members and class period on each base,
- Select 2-3 materials that relate to your group's design idea.
- Mount the materials to the mounting base using a glue stick, hot glue, or stapler.
- Place a piece of Painters tape vertically on the left side of each sample. This will represent the uncoated area.
- When your teacher is ready, your group will go outside to prepare your samples with the first coat of Neverwet.
- ***Teacher Note:*** *A Second coat of never wet should be applied 30 min AFTER the first coat. Depending on class schedules, this may be done by students or teachers.*
- Allow prepared samples to dry overnight.

Web Resources:

Neverwet Video Instructions
1.2.1. Lotus Leaf PPT
Zoom into Lotus Leaf
Superhydrophobic Simulation
Engineers bounce water
Catapult Image

The PPT Contains the following files:
Zoom into Lotus Leaf

Superhydrophobic Simulation

Engineers bounce water

Neverwet Experiment Video Instructions