**Text

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**The Eco-Engineering Design Process**

Diagram

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**Eco-Engineering Challenges**

**What teachers provide:**

* **a problem to solve**
* **design constraints (time, cost, specs)**
* **variety of materials**
* **minimum of coaching**
* **no preconceived outcomes**
* **opportunity to test and refine**
* **a gallery walk or other opportunity**

**for students to share their work**

**A picture containing person, outdoor, tree, child

Description automatically generatedWhat students provide:**

* **curiosity and creativity**
* **resourcefulness**
* **research**
* **a design**
* **a prototype**
* **testing of prototype**
* **refinements to prototype**
* **re-testing**

**The hardest part: vulnerability / fear of failure**

**Tips for Modifying Traditional Lessons into EcoEngineering Challenges**

* Diagram, text

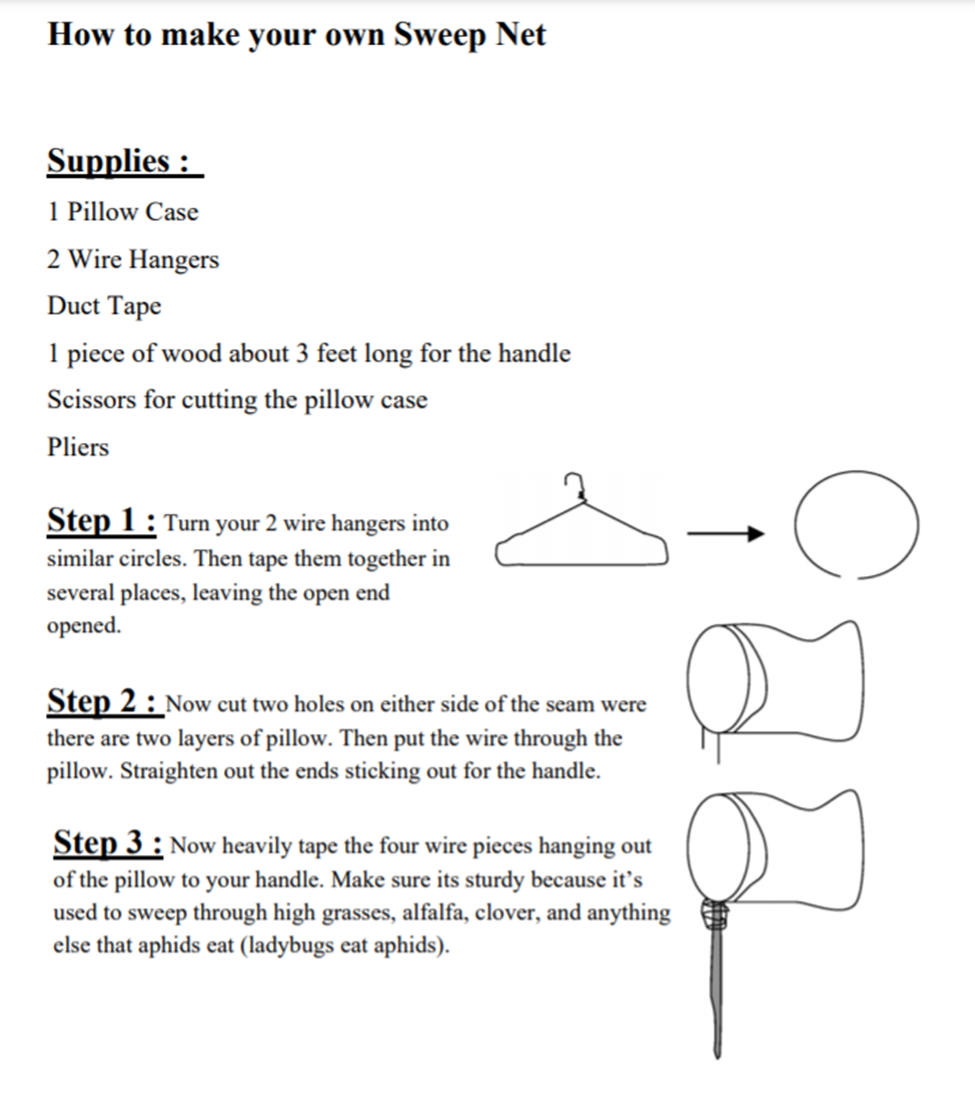
  Description automatically generated with medium confidenceProvide safety information and equipment
* Remove step-by-step directions
* Release expectations for identical results
* Value ideas from students diverse perspectives, cultures and experiences
* Engage students in engineering design process
* Provide a wide variety of materials
* Clarify constraints
* Plan time for research, design, building, testing, refinement and sharing
* Focus on process; not outcomes
* Avoid pre-conceived notions about what roles each student should play
* Collaboration, creativity and communication are important 21st c skills but innovation often comes from outlier ideas that others do not value: be flexible about group vs individual projects when possible

**Example: The Lost Ladybug citizen science project**

* Scientists need us to collect, observe, and record data on ladybugs to help determine if the elusive nine-spotted ladybug is extinct, but we don’t have equipment to catch ladybugs. How can we do this?

**Note:** The [Lost Ladybug Project](http://www.lostladybug.org/) comes with [instructions for making nets](http://www.lostladybug.org/files/SweepNet09.pdf)

**Today’s Teacher Challenge:** How would you convert the lesson instructions to an eco-engineering challenge? Complete the form labeled “Teacher-Provided Information.”

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**Teacher-Provided Information for**

**Eco-Engineering Challenge: Lost Ladybug Catcher**

**The Challenge** (Include information on how to observe a key scientific phenomenon and make sense of it, to launch this eco-engineering challenge. Specify which parts of the challenge will be conducted outside)

**Constraints**

**Materials Available**

**Curated Research Articles**

**Student Lab Report for**

**Eco-Engineering Challenge: Make a Ladybug Catcher**

**PROBLEM**

**RESEARCH FINDINGS**

* .
* .
* .
* .
* .

**BRAINSTORMING**

**DESIGN: labeled drawing**

**BUILD: then insert or paste a photo of what you built**

**TESTING: describe how you tested your prototype; what worked; what didn’t**

**REFINEMENTS: how did you change your design? Did it affect performance?**