Driving Question:
What data do I need to improve my design?

Overview
In this lesson, student will incorporate feedback from community members to improve their designs before they prototype it. Engineering design solutions for sustainable communities relies on iterative decision-making that includes problems and perspectives of community stakeholders.

This iterative process changes as new social and technological dimensions are (re)defined when collecting ethnographic data and during the analysis process. In this lesson, student will incorporate feedback from community members to improve their designs before they prototype it.

Lesson Standards

- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved

Objective
Students will improve their engineering designs using technical tests and community feedback.

I Can Statement
I can improve my engineering design using technical tests and community feedback.

Materials
- All of the prototyping supplies from lesson 8
- Prototypes of engineering designs

Equipment
- All of the prototyping equipment from lesson 8
- Audio recording device
Background for Teachers

Here students are conducting technical tests on their designs. They do this first to optimize their design before they get social specification feedback.

Here students are getting social feedback on their design. Students can do informal interviews with individuals in your building. At this point, students will be working predominantly on their own pace.
Refining Your Prototype
Through technical tests and community feedback

Lesson 09
2 Class Periods

Lesson Sequence
I. Design and complete three technical tests
II. Optimize design based on technical tests results
III. Design and conduct interview for social specifications
IV. Optimize design based on community member feedback

I. Design and complete three technical tests

A. Introduce today’s objective to optimize the design through technical tests.

TIP
• Students have agency in designing the types of tests they think are important.

B. In your ideal engineering dream, describe in one or two sentences exactly how your prototype works. You need to include something about a) your power source, b) your load, c) the function.

Sample sentence starter: My prototype [name] uses [name power source] to power [name load] to [do what? Name function].

My Woot Wall uses a hand crank to power 12 LED lights to celebrate students’ accomplishments.

TIP
• You are recognizing students’ expertise for what they think matters.

C. As a group, list all of the ways you already improved your design. Ex. We switched from a series to a parallel circuit. We colored the lights.

D. How will you test your design to get ideas for how to improve it? This will support all youth in have a role in the interview, and will help them to get started in the interview...

Technical question:
• [if my design is working] Can I see all of the lights from the back of the classroom?
• [if my design is not yet working] Can I figure out why it is not work?

Sustainability question:
• How can I improve my design so that it can last for the rest of the school year?
Refining Your Prototype
Through technical tests and community feedback

Social question:

- Do people like it?
- Record your results in the handout

TIP

- By revising their designs, students are adding sophistication to their design and engaging in authentic engineering work.

E. Design Tests for each question (see handout)
   Include: How the test will be conducted? What data will be collected. How will your test be a “fair test”?

F. Review class norms for projects

G. Have groups design and test three tests

H. Have students record their results in the “test your prototype” hand-out

II. Optimize design based on results

A. Have students draw the changes they are going to make on their original sketch up based on the technical tests.

B. Have students make the changes on their actual prototype.

C. As a class, have groups share what changes the groups made to improve their prototypes
Name: ____________________________________

Group Name: ________________________________

**How does your design work:**
Our prototype [name] uses [name power source] to power lights to [do what?].

Our prototype ________________________________ uses ______________________
to ________________________________

______________________________________________

______________________________________________

______________________________________________

We have already improved our design in these ways:

<table>
<thead>
<tr>
<th>Technical Changes:</th>
<th>Social Changes:</th>
</tr>
</thead>
</table>

*Make sure you draw all of those changes on your sketch up.*

**Testing my Design:** Conduct each test **3 times** to ensure you have a fair test.

<table>
<thead>
<tr>
<th>Test #01</th>
<th>Technical</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test:</td>
<td></td>
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</table>
**Testing my Design:** Conduct each test **3 times** to ensure you have a fair test.

<table>
<thead>
<tr>
<th>Test #02</th>
<th>Sustainability: will it last?</th>
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<tbody>
<tr>
<td>Test:</td>
<td>Results</td>
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<table>
<thead>
<tr>
<th>Test #03</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test:</td>
<td>Results</td>
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<td></td>
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</tbody>
</table>

What did I learn about these tests of my design?

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**Draw and list the changes you will make to your design on your sketch up**
Refinar su prototipo
Poner su prototipo a prueba | Lección 09

Nombre: __________________________________________

Nombre del grupo: ______________________________________

Cómo funciona su trabajo de diseño:
Nuestro prototipo [nombre] usa [incluyan la fuente de energía] para encender las luces para que [¿hacer qué?].

Nuestro prototipo ___________________________ usa ___________________________
________________________________________ para ____________________________________
________________________________________

Mejoramos nuestro diseño de las siguientes maneras:

<table>
<thead>
<tr>
<th>Cambios técnicos:</th>
<th>Cambios sociales:</th>
</tr>
</thead>
<tbody>
<tr>
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Asegúrense que dibujen todos los cambios

Probando nuestro diseño: Lleven a cabo cada prueba tres veces para asegurarse que los resultados son constantes.

<table>
<thead>
<tr>
<th>Prueba</th>
<th>Técnica</th>
<th>Resultados</th>
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<tbody>
<tr>
<td>#01</td>
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Refinar su prototipo
Poner su prototipo a prueba | Lección 09

**Probando nuestro diseño:** Lleven a cabo cada prueba tres veces para asegurarse que los resultados son constantes.

<table>
<thead>
<tr>
<th>Prueba #02</th>
<th>Sostenibilidad: ¿durará?</th>
<th>Resultados</th>
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</thead>
<tbody>
<tr>
<td>Prueba:</td>
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<tr>
<th>Prueba #03</th>
<th>Social</th>
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<tbody>
<tr>
<td>Prueba:</td>
<td></td>
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¿Qué aprendí de las pruebas acerca de mi diseño?

Dibujen y hagan una lista de los cambios que harán a su diseño.