The Science and Practice of

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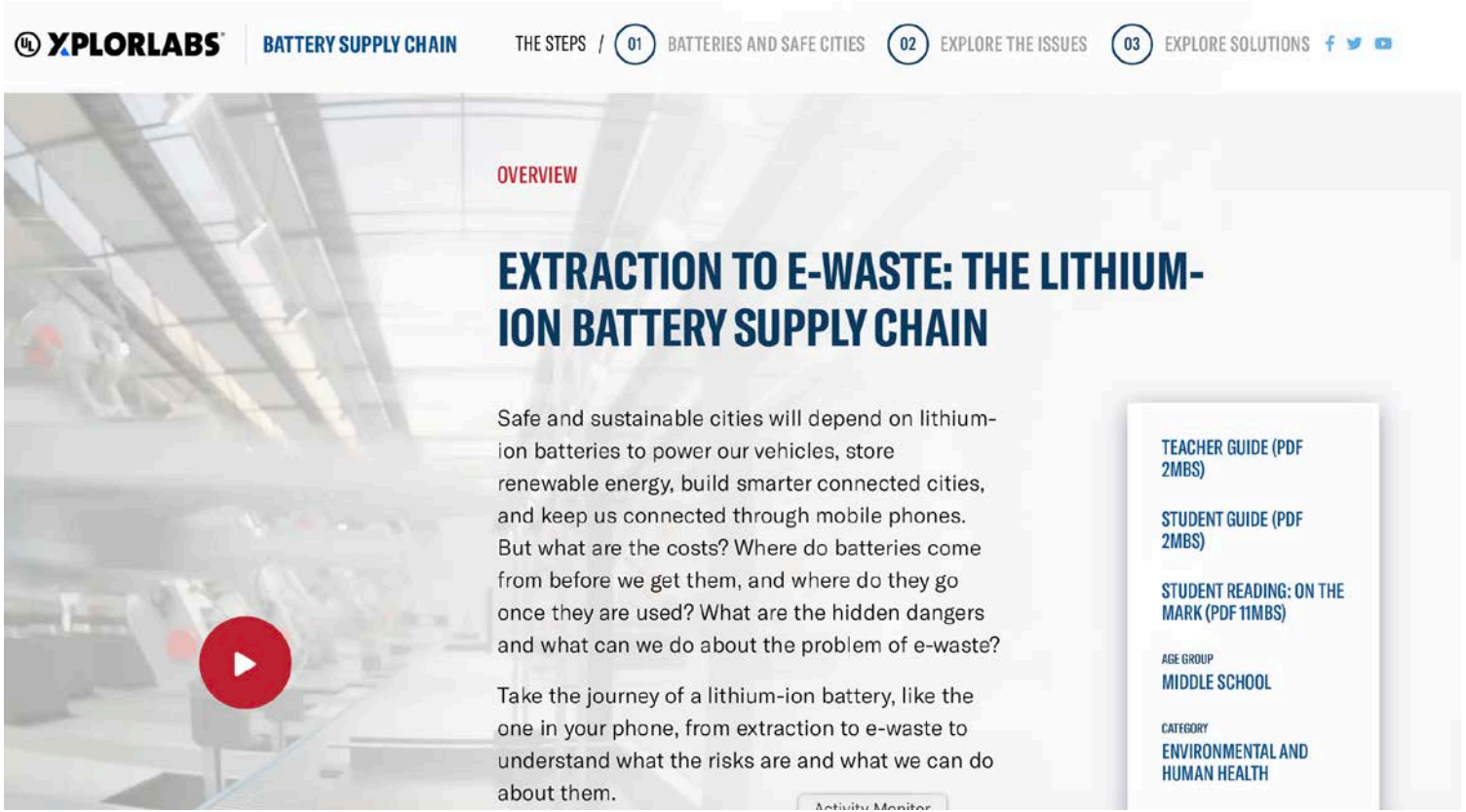
The Xplorlabs Extraction to E-waste Module



The Practice of Extraction to E-waste

July 15, 2020

Katey Shirey, Ph.D.
Founder, eduKatey

Purpose:

To help educators leverage engineering design for increased student learning.

To use the module in backward design to engage students in deep exploration and analysis of proposed solutions to the problems that Battery Supply Chain illustrates.

The Practice of Extraction to E-waste

July 15, 2020

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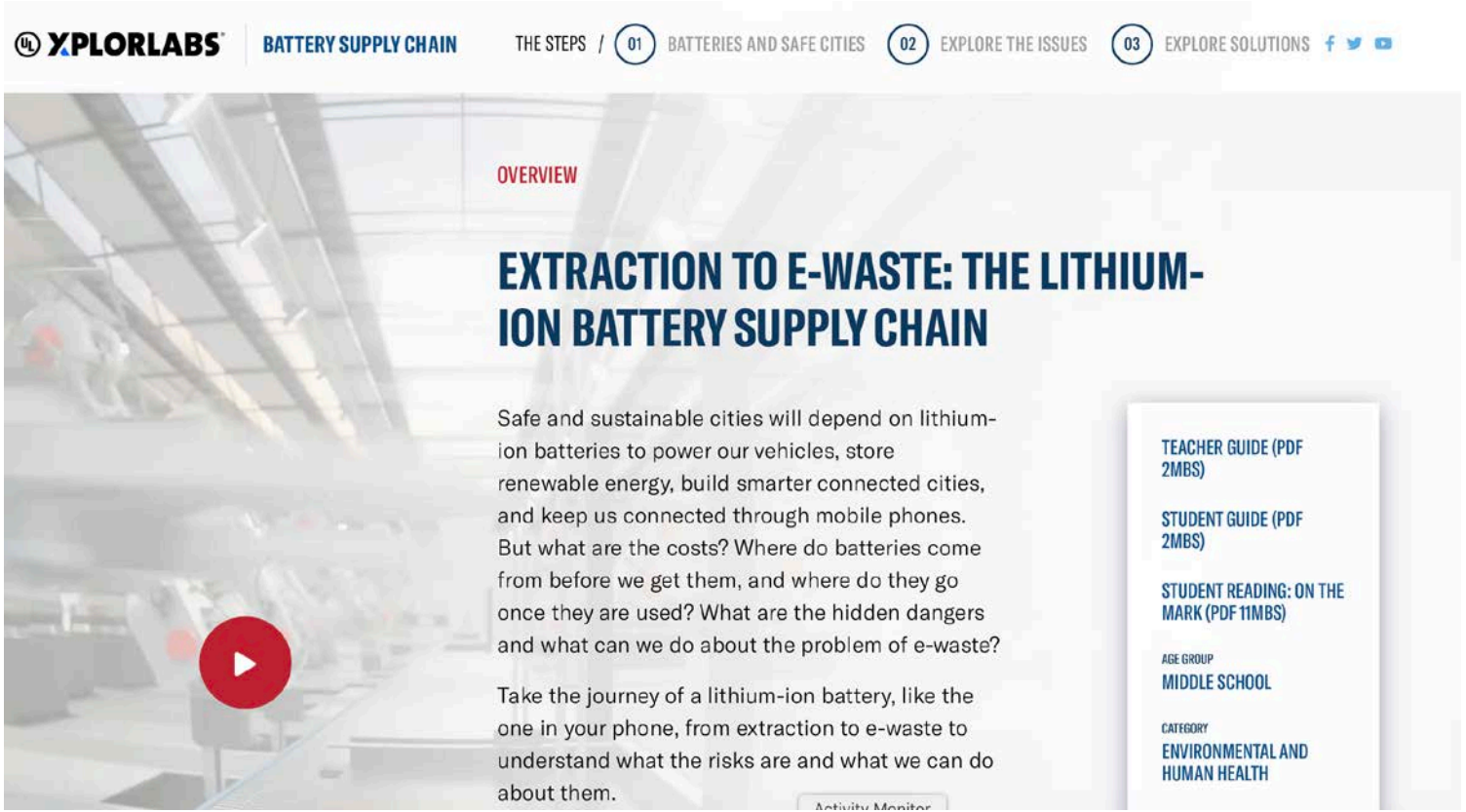
Agenda:

- Major content themes in the module
- Two ways to use the module with students
- Practice investigating the module with an engineering design process
- Explore, brainstorm, and share content connections

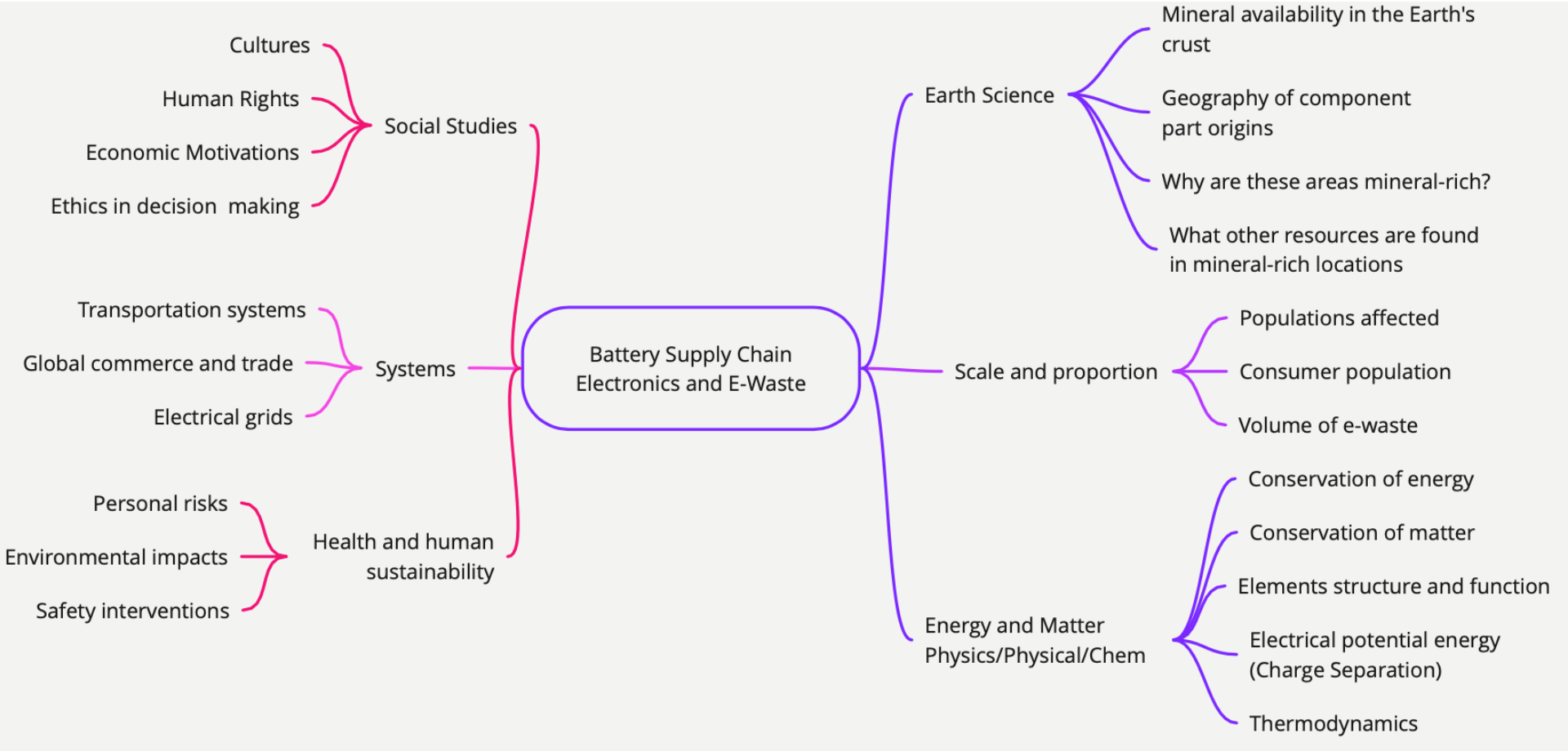
Quick self-check:

How confident are you in turning your classroom content into an engineering design challenge?

The Xplorlabs Extraction to E-waste Module



Major Content Areas in the Modules



Teacher Guide

OVERVIEW OF THE TEACHER'S GUIDE

In this guide, you will find the following:

01 Resource extraction: Where the supply chain begins

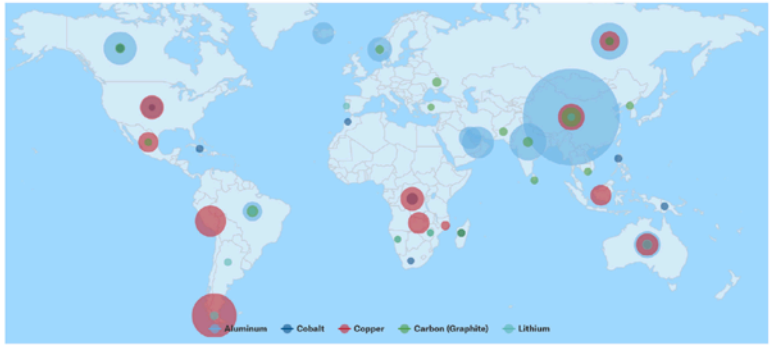
- How would you compare open pit mining and brine extraction mining methods? (Set up as t-chart or open response)
- What impacts on the land did you observe at the open-pit mines over time? What year did the changes increase? What else was happening at that time?

02 From raw materials to battery cells

- Describe how a pouch cell battery is made?
- What is an exothermic reaction?
- What are the defects that can cause a short circuit?
- How would this be a problem later on in the supply chain or when the device is in your hands?

Student Guide

Where are these resources located?



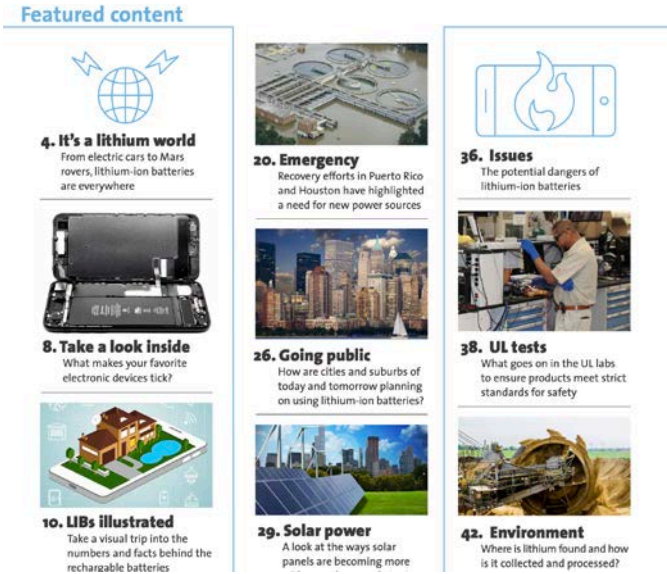
Source: U.S. Geological Survey, Mineral Commodity Summaries 2019

See what you learned!

- How would you compare open pit mining and brine extraction mining methods? (set up as T-chart or open response)
- What impacts on the land did you observe at the open-pit mines over time? What year did the changes increase? What else was happening at that time? What are the risks of lithium-ion batteries?

On the Mark Reader

50-page full-color PDF resource to augment the information on the website and in the Student Guide.



So, how do you teach it?

Linear Sequence

6 Module Sections, step through them together

00 Introduction: Anatomy of a lithium-ion battery

01 Resource extraction: Where the supply chain begins

02 From raw materials to battery cells

03 Shipping and transporting batteries to assemble your mobile phone

04 The mobile phone has finally arrived

05 What happens to batteries and our devices when we no longer use them?

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Alternative Engineering Design Sequence

Use the module’s proposed solutions to motivate design exploration and optimization

Start with one of the module’s Solutions videos as a hook.

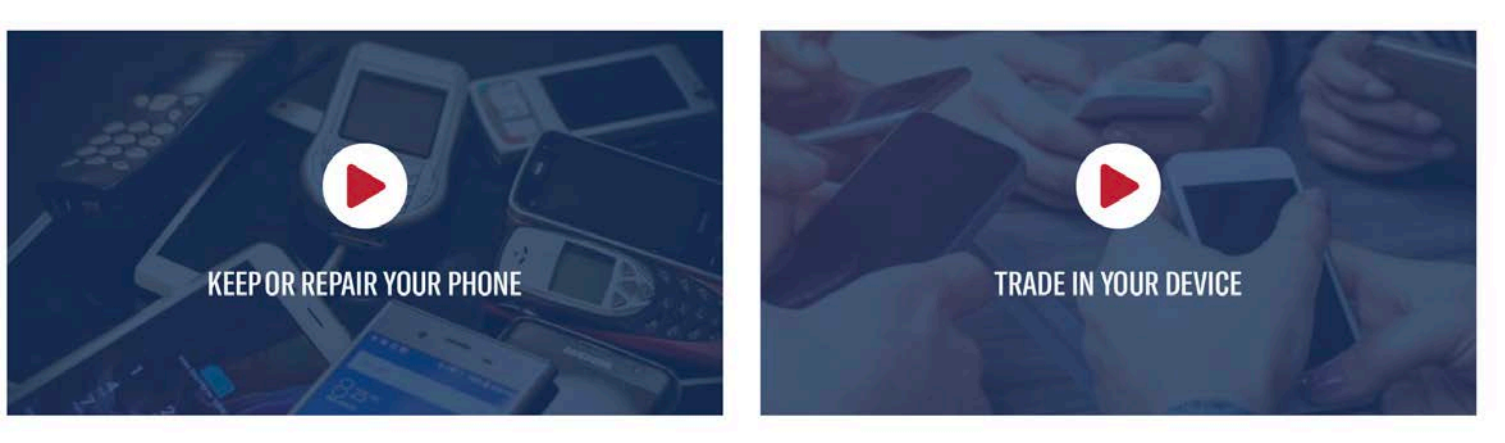
Select one that will allow you to focus your students on *your* content.

Alternative Engineering Design Sequence

Use the module’s proposed solutions to motivate design exploration and optimization.

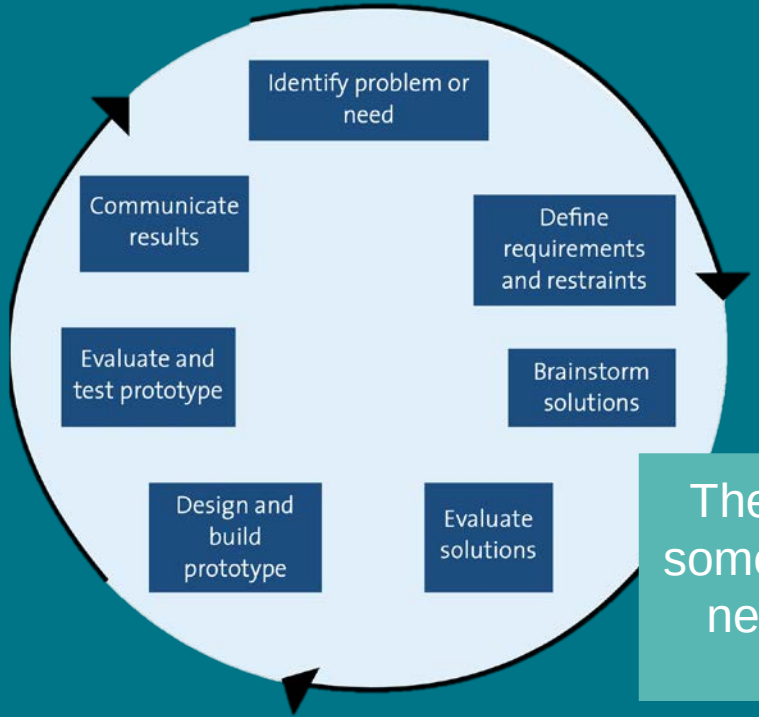
Start with one of the module’s Solutions Videos as a hook and contestable call to action.

Select one that will allow you to focus your students on *your* content.



Alternative Engineering Design Sequence

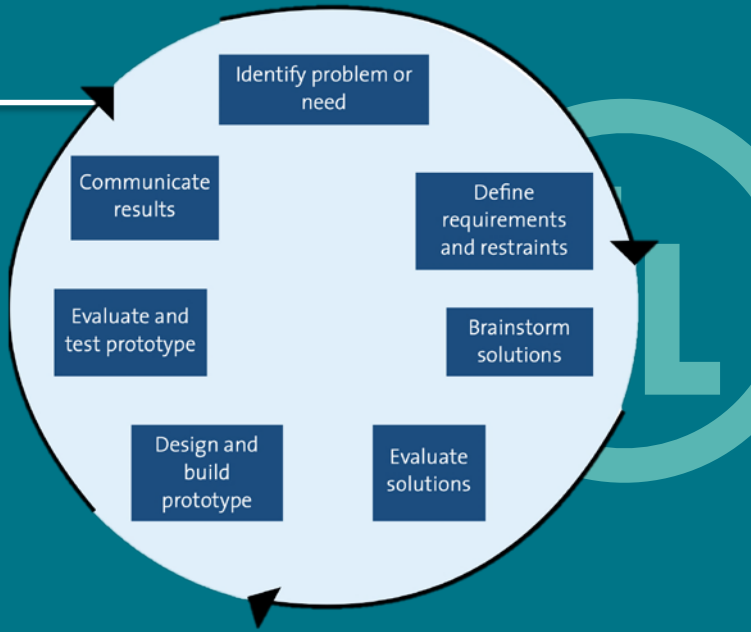
Use the module's proposed solutions to motivate design exploration and optimization.



The module provides some solutions, and we need to do the rest.

Alternative Engineering Design Sequence

Today, as students you will practice this sequence:



Start with one of the module's Solutions videos as a hook.

Next, back up to learn what the problem is all about. Define the requirements for a successful solution.

Identify other ideas that have or have not met this challenge.

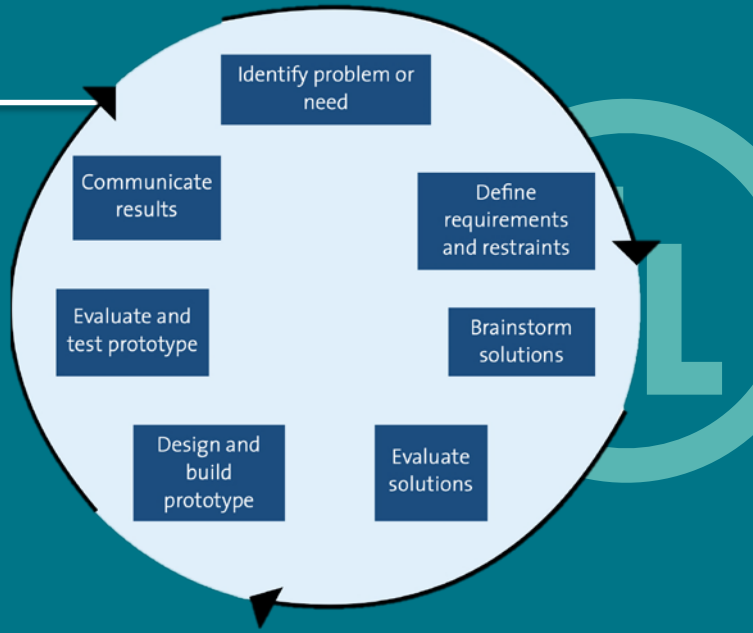
Decide how to test solutions to determine "success."

Evaluate the proposed solution in the video.

Prepare a final product to demonstrate your knowledge of the entire problem and how this solution works and doesn't work to meet the problem.

Example: How successful is “Dematerialization”?

Let’s walk through the sequence:



I’d watch the Dematerialization video. The propose solution is, Use less material in the product.

Next, back up to learn what the problem is all about. Define the requirements for a successful solution.

Identify other ideas that have or have not met this challenge.

Decide how to test solutions to determine “success.”

Evaluate the proposed solution in the video.

Prepare a final product to demonstrate your knowledge of the entire problem and how this solution works and doesn’t work to meet the problem.

Your turn! Let’s try it

Today, as students you will practice this sequence:

Start with one of the module’s Solutions Videos as a hook: Mechanization and Automation

>>Let’s watch the video<<

Your turn! Let’s try it

Today, as students you will practice this.

Start with one of the module’s Solutions Videos as a hook: Mechanization and Automation

The video suggested that mechanization and automation will help with the following problems:

- Dangerous to humans. *Who’s affected?*
- Production steps are dangerous. *In what ways?*
- Harmful chemicals. *Which?*

Your turn! Let’s try it

Today, as students you will practice this sequence

Start with one of the module’s Solutions Videos as a hook: Mechanization and Automation

Next, back up to learn what the problem is all about. Define the requirements for a successful solution.

Identify other ideas that have or have not met this challenge.

Decide how to test solutions to determine “success.”

Evaluate the proposed solution in the video.

Prepare a statement to demonstrate your knowledge of the problem and your reasoning. We’ll share our thinking in the chat with the form:

→ I recommend ___ to deal with the issue of _____ because _____.

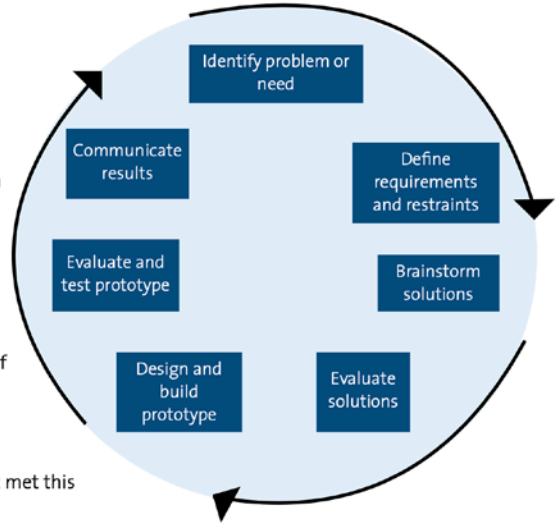
Using the Engineering Design Sequence

Today, as students you will practice this sequence. We are sending you an overview doc now to orient you in TEACHER HAT.

Using UL Xplorlabs: Extraction to E-waste
Engineering Design Process Tool
By Dr. Katey Shirey, www.edukatey.com

Engineering design usually follows a general methodology from defining a problem to exploring possible solutions, testing and improving those designs (design optimization), and then sharing the design and its justifications based on data. You may have seen this process described in many ways; for example, a circle or a flow chart. No matter how you prefer to illustrate this process, the four boxes on the next page will be a central part of your process.

We're going to start with the Solutions Videos from Extraction to E-waste. These videos are solution ideas ready to be evaluated. Your students are tasked with **evaluating these proposed solutions**. To do this, they'll need to work in all parts of the design process:



Flowchart Attribution: Steven Krause

1. Backing way up to discover what the problem was all about (problem definition)
2. Identifying other potential ideas or historical shifts that have or have not met this challenge
3. Determining what testing limits the solution would need to meet to be a "success"
4. Now that we know more about the problem, let's evaluate the proposed solution in the video
5. Finally, prepare a final product to demonstrate your knowledge of the entire problem and how this solution works and doesn't work to meet the problem. Examples:

Your turn! Let’s try it

Today, as students you will practice this sequence

Fill in the fillable portions of the doc based on the “Mechanization and Automation” video and your exploration of the module.

>>Let’s watch the video again.<<

Assignment:
Explore the module and use the Student Tool to create a justified recommendation for supporting or not supporting the solution in the video. (15 mins)

Mechanization & Automation

What recommendations can you justify?

In the chat: What is your justified recommendation?

→ I recommend ___ to deal with the issue of _____ because _____.

Structured discussion or online discussion board prompts:

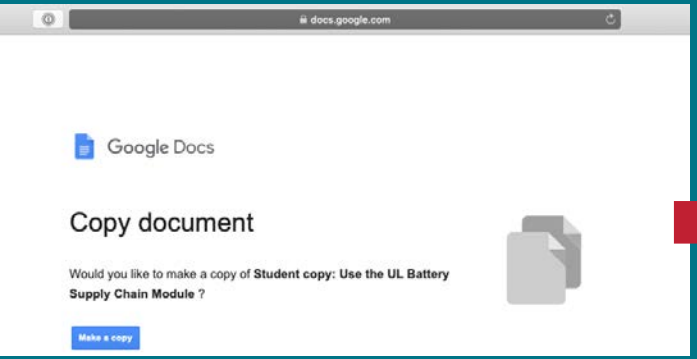
- Why is mechanization and automation a great idea?
- What issues does mechanization and automation not resolve?

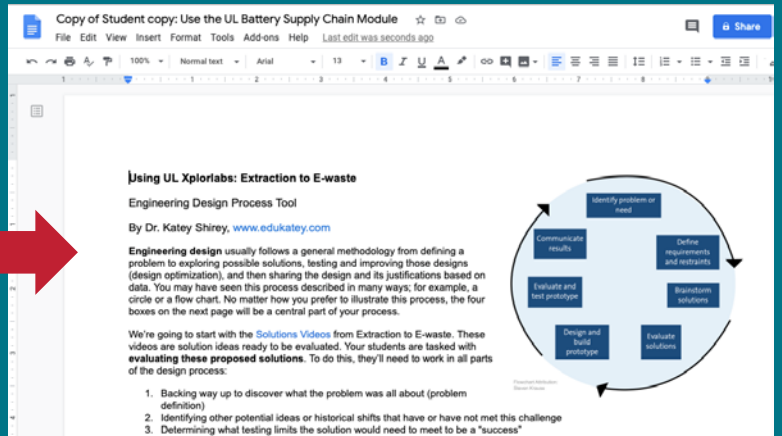
Your turn! Let’s try it

To participate as a student in a fillable doc, please click on the link we’re sending to you.

It will ask you to make a copy. Please sign into Google Docs to make a copy.

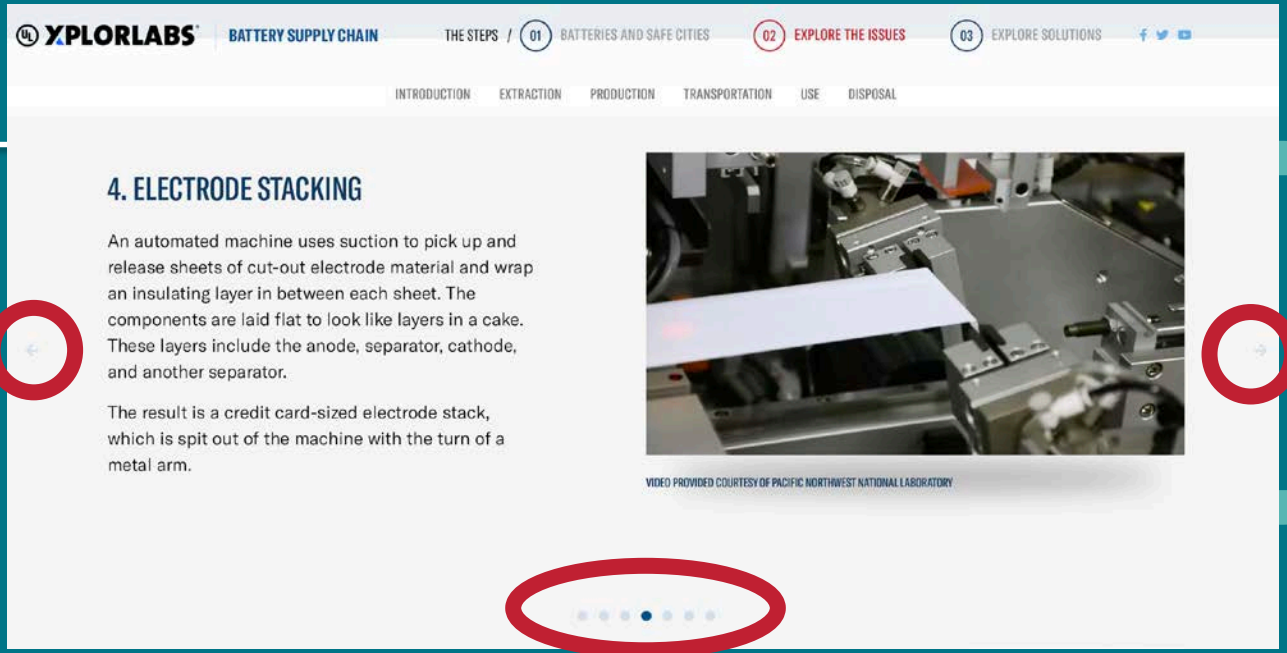
If that doesn’t work for you, feel free to write your own notes based on the PDF distributed earlier.





Your turn! Let’s try it

What should you expect?



Assignment:
Explore the module and use the Student Tool to create a justified recommendation for supporting or not supporting the solution in the video. (15 mins)

What is your recommendation?

Let’s do a chat waterfall and then read over them.

Type or copy your justified recommendation into the chat. Don’t press enter yet!

On the count of three, press enter.

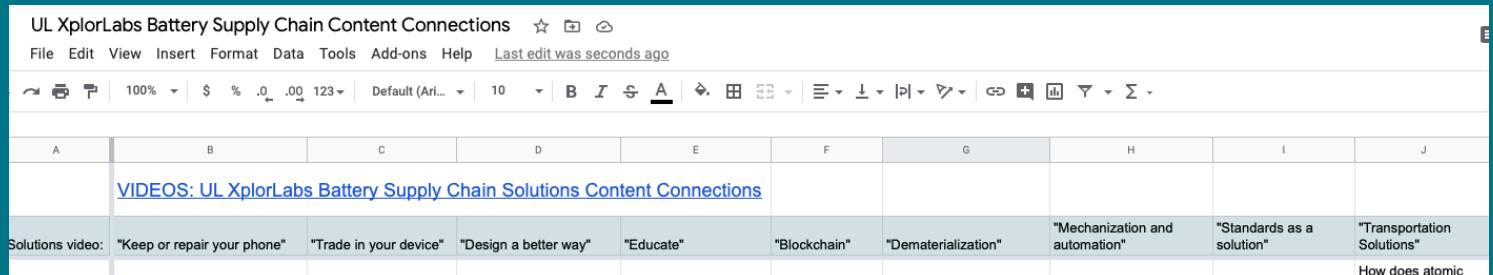
Where is the content?

How can you plan a similar activity to meet your content needs?

Planning for your content needs

Our next activity: Review several videos & brainstorm content connections

- Review several solutions videos on the UL module solutions webpage. Consider which content-area instruction, inquiry, or investigation that **you** would structure with this module.
- List possible content connections on the same fillable Google Doc (scroll down for Activity 2).
- When you're ready, head to the linked Google Sheet and add your ideas for others to see. Please add at least one. UL is very interested in your input and ideas for future workshops.

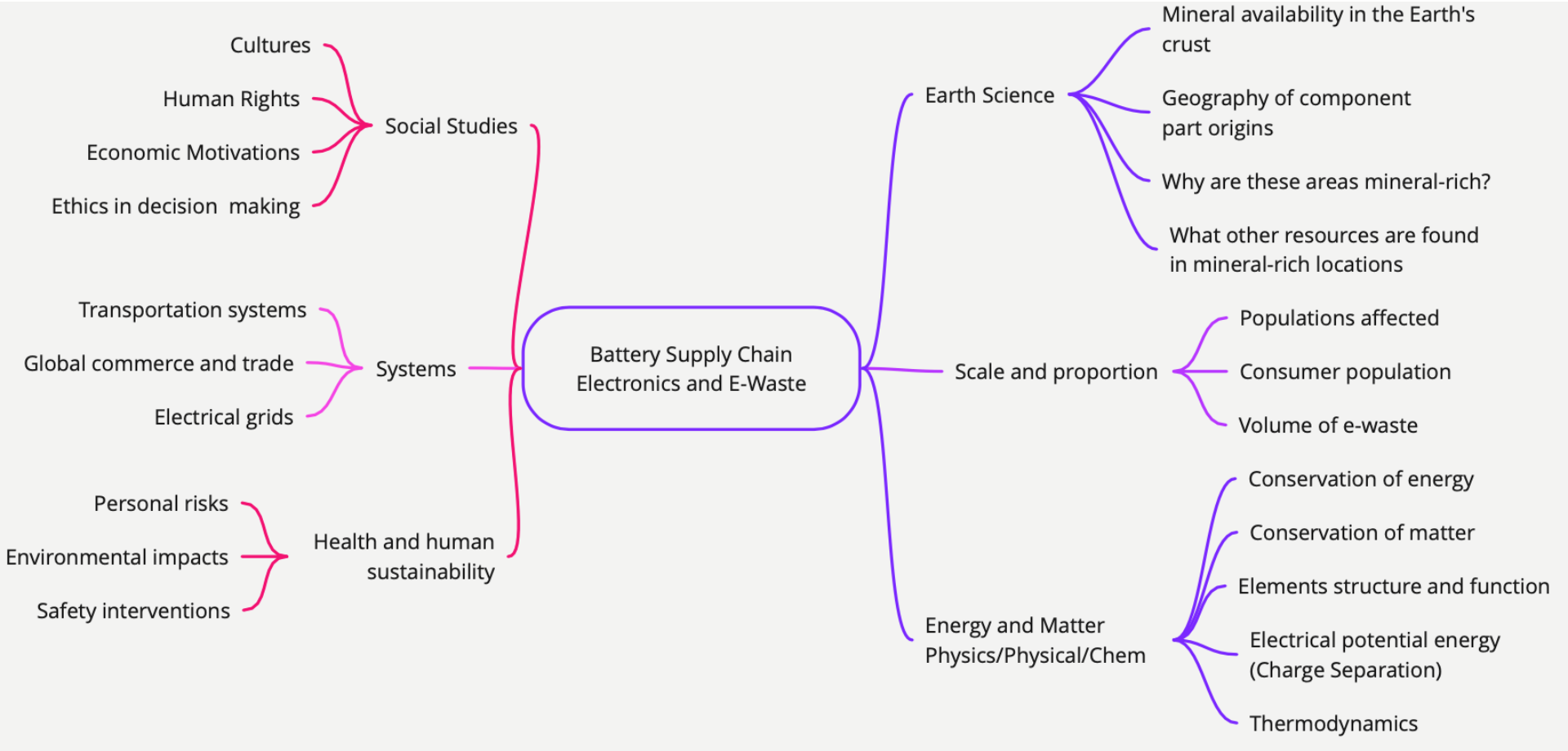


Reminder: Your Tools

Tools:

- The content connections map slide
- Teacher-facing PDF of how to drive an investigation from a solutions video using the engineering design process scaffold.
- Your own resources and interests! Your labs, your projects, etc.

Major Content Areas in the Modules



Your ideas:

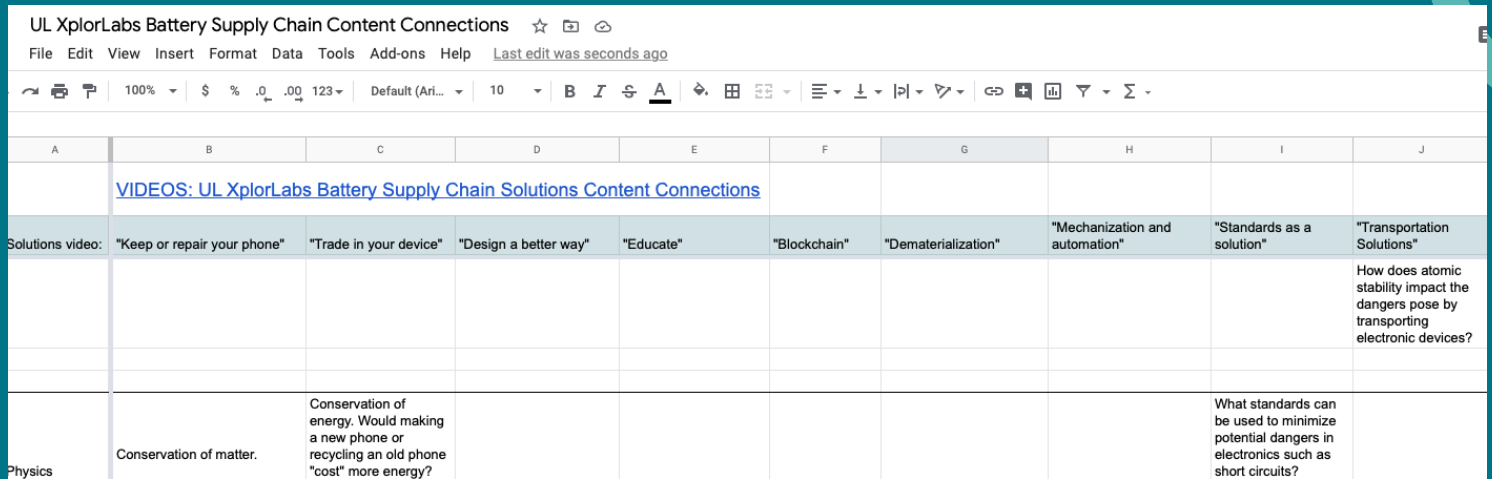
Let’s brainstorm how we could use this module with students.

Your ideas:

Let’s brainstorm how we could use the UL Solutions Videos to drive content learning

Review the UL Solutions videos and generate ideas (5 minutes, link in sheet by chat).

Add ideas to the Google Sheet (available in the chat).



UL XplorLabs Battery Supply Chain Content Connections

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	A	B	C	D	E	F	G	H	I	J
		VIDEOS: UL XplorLabs Battery Supply Chain Solutions Content Connections								
	Solutions video:	"Keep or repair your phone"	"Trade in your device"	"Design a better way"	"Educate"	"Blockchain"	"Dematerialization"	"Mechanization and automation"	"Standards as a solution"	"Transportation Solutions"
										How does atomic stability impact the dangers pose by transporting electronic devices?
	Physics	Conservation of matter.	Conservation of energy. Would making a new phone or recycling an old phone "cost" more energy?						What standards can be used to minimize potential dangers in electronics such as short circuits?	

Your great ideas!

Wrap up:

You should now have several ways to use the UL Battery Supply Chain module:

1. Step through the module, assign topics, have students take notes and answer discussion prompts. (Follow the teacher guide on module website.)
2. Analyze proposed solutions using the module.

   Start with proposed solutions as hooks and use an engineering design process to structure problem definition, design exploration, design optimization (testing) and design communication.
3. Introduce the module (or parts of the module) to investigate, augment, or illustrate your content instruction.

Thank you for participating!

What questions do you have for me?

Feel free to email: katey@edukatey.com

Additional Webinars

Questions & Answers