Using UL Xplorlabs®: Extraction to E-waste

Engineering Design Process Tools: "Student Hat" Version for Educators

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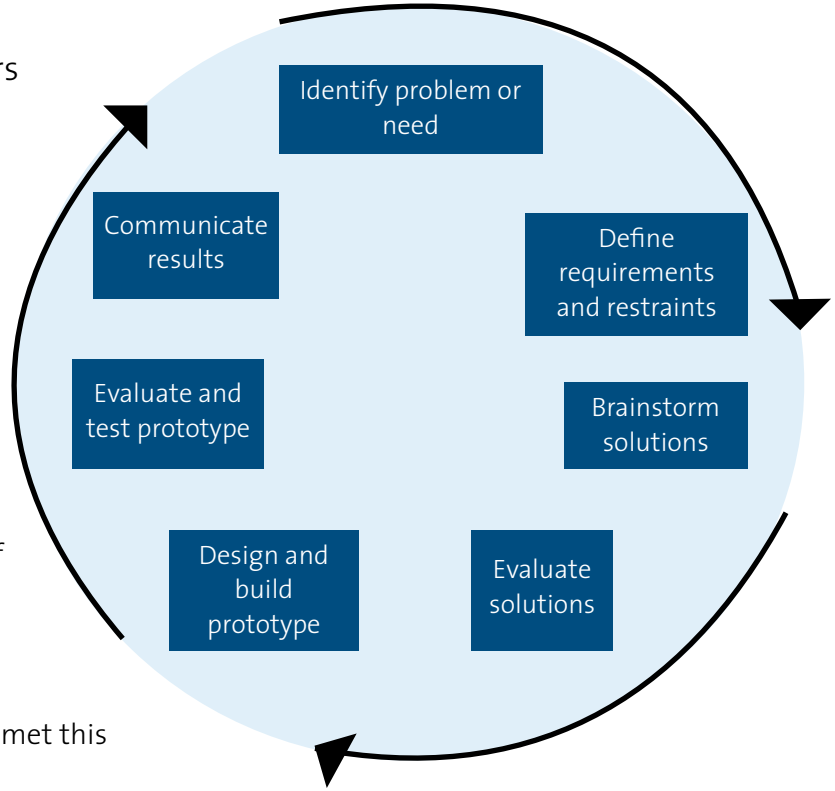
Engineering design usually follows a general methodology from defining a problem to exploring possible solutions, testing and improving those designs (design optimization), and then sharing the design and its justifications based on data. You may have seen this process described in many ways; for example, 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.



Flowchart Attribution: Steven Krause

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:

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:
    a. Prepare a critique of the solution proposed in the video. Who does it take care of? Who does it leave out? Which stakeholder's perspective does it privilege?
    b. Make an accompanying white paper/pamphlet/handout that explains more about the problem and why this solution works or doesn't work. (more advanced) Include metrics for populations affected and estimated costs.
    c. Propose a strategy to test this solution. Who would need to be involved?

1. Start here:

*The module's Solution Videos are each a description of one idea to solve a problem in the Battery Supply Chain. If we were engineers, we'd still need to optimize that solution and test it to see whether it meets our criteria.

But first, we'll need to understand the whole problem, so we will need to dive into the module to explore the factors that can contribute to the solutions. The UL Xplorlabs: Extraction to E-waste module begins here.

2. Problem Definition	3. Design Exploration	4. Design Optimization	5. Design Communication
What is the problem? A solution would need to resolve **these** concerns to be a success: • Constraints (limits, minimums, maximums, requirements) • Criteria (trying to achieve these as much as possible) • Stakeholders **A solution would need to deal with:** • •	Brainstorm all kinds of possible solutions to this problem that you see in the modules, solutions that have been tried in the past, and solutions that you can think up now. Ideas: • Use a Venn Diagram graphic organizer to compare two solutions, then identify which has outstanding positive or negative attributes or side-effects. **What are other possible solutions?** • •	**Does the proposed solution meet the needs that you've discovered for this problem?** • **How might you alter the solution to meet more of the needs you've discovered?** • **What data would you need to see to evaluate the solution as a success?** • •	Communicate the solution and your justification for the solution based on the exploration you've conducted. Show the video and provide your supplemental materials. Answer questions from others using your experiences in the module to justify your reasoning. **What rationale justifies your reasoning?** • •

6. Prepare to share.

We'll share our thinking with the form: **"I recommend _____ to deal with the issue of _____ because _____."**

Activity 2: **Brainstorm content connections motivated by solutions videos**

Review several Solution Videos. Try watching two or three videos to start. List possible content connections that you see below. When you're ready, head to the collaborative spreadsheet (example here) and add your ideas for others to see. Please add at least one idea in your most-aligned content area.

Keep or repair your device	Trade in your device	Design a better way	Educate	Blockchain

Dematerialization	Mechanization and automation	Standards as a solution	Transportation solutions

Research as a solution	Designing phones to be modular	Regulation as a solution	Circular economy

Notes from Katey Shirey:

Useful links:

- UL Xplorlabs: Extraction to E-waste solutions videos
- UL Xplorlabs: Extraction to E-waste module start page
    - **Batteries and safe cities** is an overview ("Introduction") --I might go through this as a class like Kelly did with you at the beginning of this workshop
    - **Explore the Issues** starts with *Resource Extraction*.

Other notes from Katey:

- For the task in this workshop, I want to help you hunt for information relevant to "mechanization and automation," so I recommend spending time on the risks associated with UN-automated resource extraction, processing, assembly, transportation, and/or disposal. You might choose to focus on one of these to build your justified recommendation.
- Observe the embedded videos carefully. Peek through the pop outs. Take notes in your Google Doc. You are in a student hat but still an adult with experience and background knowledge. You are allowed to include that knowledge, but your recommendation will be more justified if you gather data from the modules to cite in your rationale.