TECH TIP: Framing the Challenge

How you frame a design challenge is key to engaging learners in the iterative design process. The Tech's design challenges are rooted in real-world problems and allow for a variety of different solutions to ensure they engage all learners.

In addition to the basic problem in the design challenge, "framing the challenge" also includes defining criteria and constraints. These guide engineers and designers through the Innovation Design Process by providing insight, clarity and focus around the challenge. Criteria are guidelines and features that define the success of the design (function and style). Constraints are the real-world limits on the design (size, budget and schedule, environmental/human impact). Well-framed design challenges will engage all your learners, especially those who feel less confident or connected with STEM, design or building. Generating many possible solutions (that even the educator has not come up with) provides the students with agency in being able to contribute a unique point of view based on their experiences and expertise. Additionally, incorporating a narrative (or premise) that invites imagination can increase learners' sense of ownership with the design challenge and creates a place where they can shine.

FACILITATION: DEFINING CRITERIA AND CONSTRAINTS

Criteria and constraints are essential to push learners to optimize a design, while creatively considering the potential impact on the world and connecting to concepts from learners' worldview.

- For **novice engineers** and designers, start by providing the criteria and constraints and work toward having them identify criteria and constraints in subsequent sessions.
- **Experienced engineers** and designers should increasingly develop the criteria and constraints for challenges on their own. Given a specific challenge, learners should define criteria and constraints that invite imagination, connect to the real world and incorporate their experiences while staying open enough to provoke multiple solutions.

DEFINING CRITERIA

- Pose a discussion question — *"For this challenge, what does success mean to the group and how is it measured?"*
- Record and refine ideas on the board. Ask follow-up questions to focus them in certain areas — from environmental impact to aesthetics:
  - How will we know if the solution has a low impact on the environment and a high impact on the people it may serve?
  - Who will be using your solution? How can you optimize it for them?
  - Does your solution elicit wonder?
  - How will your designs align with the aesthetic of the community?
- Deciding as a group on the criteria for the best solutions to the problem enables learners to think critically about the problem and their designs and is another opportunity for collaboration.

FACILITATIVE QUESTIONS

Developing Criteria/Constraints

- How will we know if the designs are successful (criteria)?
- Given this design challenge, what do you want to do (criteria) and what rules might limit the design (constraints)?
- What are potential real-world constraints that will limit our design possibilities?
- Who am I making this for? Does this design serve everyone?
- Who will have access to this solution?

Re-focusing Participants on Criteria/ Constraints

- How well does your design meet each criteria and constraint of this design challenge?
- How will your next iteration address specific criteria or constraints?

DEFINING CONSTRAINTS

- Discuss with students what the real-world constraints are on this design challenge: timeframe, materials, accessibility, environmental impact, budget and human capacity/ability (emotional, mental, and physical).
    - Time Frame: Focus them on real-world reasons for schedule to help learners understand schedule drivers (e.g., the new gutter system needs to be designed before the rainy season starts).
    - Remind learners that constraints help keep designs practical and relate directly to the given situation (e.g., the CO_2 filter must be made with non-essential materials of the Apollo 13 spacecraft).
- Constraints with materials
    - Availability of materials in your space can be a natural budget constraint and can inspire innovation and upcycling (e.g., We are out of wooden dowels. What else can you use for that purpose?)
    - Create materials constraints to support the build time (using fewer materials is often helpful if teams have less build time).

For Tech Tip facilitation videos, visit **thetech.org/resources**.