

# Facilitation Tips

## The Engineering Design Process and Building Your Student's STEM Identity

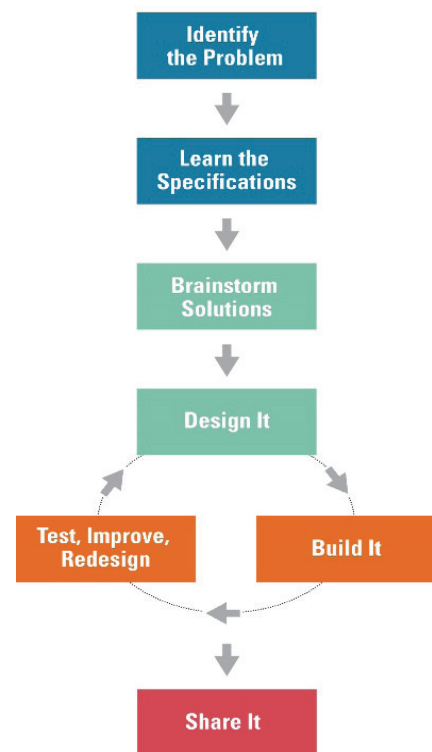
DiscoverE's engineering activities are structured around the engineering design process. Our activities are open-ended design challenges that require few materials and encourage student-directed learning.

Not only are our activities engaging and low-cost, they are a critical step in building a student's engineering identity.

### What is the Engineering Design Process?

You'll see various versions of the engineering design process, but it generally follows these seven steps:

- **Identify the Problem:** Understanding the problem is critical to solving it.
- **Learn the Specifications:** Discover what materials are available, find out any constraints, and understand what success looks like.
- **Brainstorm Solutions:** Coming up with many possible solutions paves the way for solving it.
- **Design It:** Now it's time to choose the best solution and plan how to create it.
- **Build It:** Just like the name suggests, this is the building phase.
- **Test/Redesign:** What's working? What's not working? What improvements do you want to make?
- **Share It:** Presenting your work is a constructive way to conclude a project.



**REMEMBER:** It's not a linear process. When you see a graphic of the process, it looks like a nice straight line. But oftentimes people begin in one step and move back and forth between steps numerous times.

## Facilitation Tips When Using the Engineering Design Process

### When facilitating engineering activities your job is to:

1. Ask open-ended questions rather than telling them what to do. Questions that start with why and how help you gain an understanding of their thinking.
2. Recognize the student's effort and ideas, even if they aren't successful. Give constructive feedback — specific, detailed, and encouraging. A simple 'good job,' does not explain why you think what they are doing is good, nor what they can do to keep improving.
3. Link the activity back to real-world engineering projects.

Each step of the Engineering Design Process provides opportunities to do this. We've outlined those here.

### Identify the Problem and Learn the Specs

These are the most overlooked stages in the process. But when students know what problem they are trying to solve, what materials are available, and understand any design constraints you are setting them up for success.

- Do the activity yourself! Pay attention to where the instructions are confusing, if other materials are needed, or where you get frustrated.
- Are there connections to real-world engineering you can make?
- Think about how you might introduce the activity and how you can check your kids' understanding.
- Identify the engineering constraints and decide if you want to adapt them for your students.
- Decide what success looks like. This way they'll know when they're done.





## → Brainstorm and Design

Every kid wants to blow off brainstorming and design and move right to build. And sometimes that's okay. But when you take the time, there can be big rewards.

- Think about how you can encourage a high-energy, free-flow of ideas. This doesn't need to be a big group discussion. Kids can brainstorm in smaller groups or pairs.
- What strategies can you try if kids argue or criticize each other?
- How can you get everyone to participate? Sometimes those quiet minds are thinking through an idea. How can you draw it out without putting them on the spot?
- This is a great time to explore the materials before they start building. Get them thinking about the different ways they might use something.
- Try and write down all ideas, no matter how wild. The more ideas, the better.
- How can you help kids understand the value of designing *before* they build? Would they draw out their designs?
- After vigorous brainstorming, there might be lots of ideas. Ask questions to help them narrow down their ideas, like:
  - Which idea are you excited to try? Why?
  - What idea do you think will work best?
  - Is this different than the one you are excited about? Why?
- As they evaluate their designs, review them against what problem they are solving, any constraints, and what success looks like.

## → Build, Test, Redesign

Be prepared—it's loud, it's messy, it's educational!

- Establish a testing zone.
- Guide kids by asking questions. This helps kids discover the answers for themselves.  
Ask:
  - How does your idea work?
  - What have you tried so far? How did it work? Or, why do you think it didn't work?
  - Why do you think this is happening?
  - What else could you try? Or, is there another way to look at this?
- Avoid giving too much direction. It discourages kids from thinking for themselves.
- Encourage kids to look at each other's designs. Does this spark any ideas of what they'd like to change or try?
- Don't let them stop! What improvements can they make? What extra challenges do you have up your sleeve?

## → Share It

Leave time to clean up, summarize, and reflect on results.

- Ask:
  - What worked, what didn't?
  - What would you do differently?
  - What were their favorite features? Did they help or were they just cool?
  - What do they like about another team's designs?
  - What do you know now that you didn't know before the activity?
- This is also a great time to connect the activity back to a real-world challenge.



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