Inquiry Starters: Engineering

This handout provides examples of experiences you might provide for children of different ages to engage them in problem-solving and engineering. Experiences are clustered by different age groups; however, you might adapt experiences across different ages to meet the needs, abilities, and interests of your learners.

Three Ways to Engage in Problem-Solving and Engineering

- **Tinkering** creates spontaneous problems and questions children can solve as they play and explore. There might not be one specific or clear direction as children explore; however, children will use their creativity, perseverance, and problem-solving skills.
- **Literacy-inspired engineering** uses children's books to inspire engineering challenges.
- **Real-world problem-solving** offers real-life problems that children can design, create, test, and iterate.

These three different ways to support engineering might overlap. For example, you might start with tinkering, make connections to a real-world problem, and then find a book to extend children's ideas even further.

Interact With This Handout

- Make note of the experiences that may interest children in your setting.
- Plan for ways you might try out and adapt the experiences to meet the abilities and interests of children in your setting.

Tinkering

Children explore materials, test ideas, and notice cause and effect relationships. There might not be one specific or clear direction as children explore. However, children will use their creativity, perseverance, and problem-solving skills.



Building with Blocks

Encourage children to experiment with different ways to build with blocks.

- **Infants and toddlers:** Support children to experiment with stacking or lining up blocks. Support children to notice the shapes and how high or long their structures are.
- **Preschoolers:** Encourage children to create different structures that are meaningful to them (for example, the community zoo, their school, or their homes). You might offer photos of familiar buildings in their community to inspire children's building. Encourage children to explain what they are building and the different parts of their structures.
- **Early elementary-aged children:** Encourage children to build more complex structures. Children can add details to their builds that help solve a problem for "users" of the structures (for example, toy people or animals). They might explore ways to help the toy people move up or down the structure by creating stairs, an elevator, or a ramp.

Exploring Loose Parts and Recycled Materials

Provide children with loose parts and recycled materials such as leaves, sticks, rocks, flower petals, shells, mulch pieces, bottle caps, cardboard boxes, old CDs, straws, bottles, and other recycled materials. Model the tinkering process alongside children. Allow them to notice how you create freely, change your designs, or start over. Support children to create using these materials in different ways. For example:



- **Infants and toddlers:** Support children to notice the different attributes of the objects. You might encourage children to sort their objects into different categories (for example, rough and smooth textures).

- **Preschoolers:** Help children notice the shape of different materials and consider ways the shape can inform an idea such as, "This bottle cap is round. It makes me think of wheels. I wonder if we can make a car," or, "This straw is long and slender. It reminds me of the stem of a flower. Do we have anything that we could use as petals?"
- **Early elementary-aged children:** Support children in creating balancing sculptures. Children can notice cause and effect relationships, use perseverance, and test their ideas as they grapple with balancing objects in different ways.

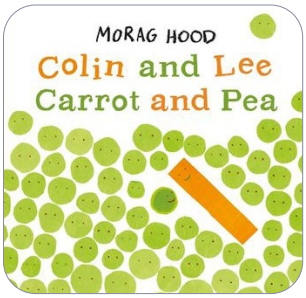
For more ideas on tinkering, visit the Exploratorium's Tinkering Projects webpage or explore the California Early Childhood Online learning module, STEAM Starters: Tinkering for Early Learners.

What are some ways children in your setting might explore problem-solving and engineering through tinkering?

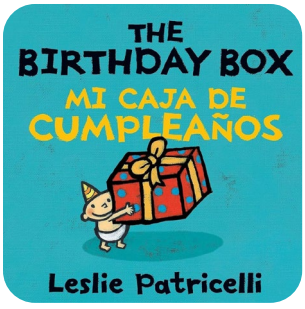
Literacy-Inspired Engineering

Use children's books and stories to inspire a context for engineering experiences. Here are a few ideas:

Infants and Toddlers



***Colin and Lee, Carrot and Pea* by Morag Hood:** Invite children to build ramps using materials such as boards, cardboard boxes, books, or blocks. Design the ramp in a way for a roller to reach a target. Encourage children to adjust the height and angle of the ramp. Does the roller reach the target? How does changing the ramp affect speed and distance? What modifications improve performance? Explore the CPE Book Guide and Activities for more ideas on ways to use this book.



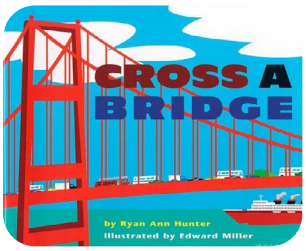
***The Birthday Box* (*Mi Caja de Cumpleaños*, in Spanish) by Leslie Patricelli:** Explore different ways to play with cardboard boxes. You might use your imagination with children to create forts, cars, or even rocket ships. Talk about the different parts of the objects you create, how they work, and what they do (for example, "Let us pretend this is the engine. Cars need engines to make them move."). Explore the CPE Book Guide and Activities for more ways to use this book.

(Ideas for books and stories continue on the next page.)

Preschoolers



***The Most Magnificent Thing* by Ashley Spires:** Encourage children to explore recycled materials. Support them to create solutions to different problems in their homes, communities, or learning settings. Explore the CPE Book Guide and Activities for more ways to use this book.



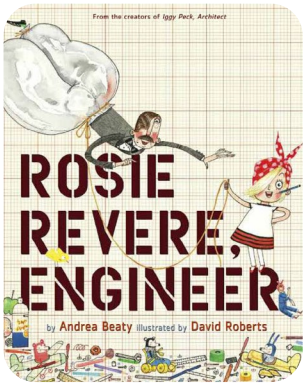
***Cross a Bridge* by Ryan Ann Hunter:** Invite children to create bridges different materials (for example, paper, cups, craft sticks). Support children to test their bridges. Does it reach from one side to another? Can something move beneath it? Can it support the weight of something on top of it?



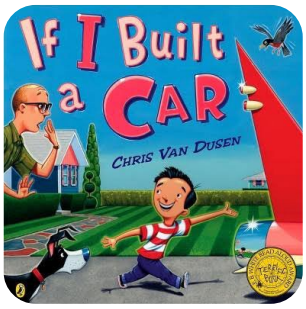
***Jack the Builder* by Stuart J. Murphy:** Support children to create different structures using blocks. Children might recreate designs Jack made in the book or create their own designs. Explore the CPE Book Guide and Activities for more ways to use this book

(Ideas for books and stories continue on the next page.)

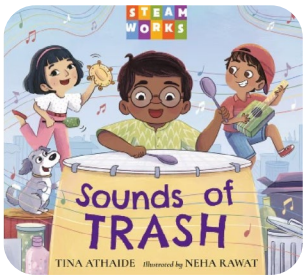
Early Elementary-Aged Children



***Rosie Revere, Engineer* by Andrea Beaty:** Design a flying machine: Provide children with recycled materials and craft supplies (for example, paper towel tubes, pipe cleaners, paper plates, and tape). Task them with creating a device that flies or hovers, emphasizing that a "failed" attempt is just a successful first try. Explore the CPE Book Guide and Activities for more ways to use this book.



***If I Built a Car* by Chris Van Dusen:** Engineer a futuristic vehicle: Encourage children to draw and then build a model of their dream vehicle. Provide recyclable materials like shoeboxes, plastic bottle caps, and cardboard boxes. Explore the CPE Book Guide and Activities for more ways to use this book.



***Sounds of Trash (a STEAMWORKS Book)* by Tina Athaide:** Create instruments using recycled materials. Children might gain inspiration from the different ways the children in the book create music or might design their own instruments that make different sounds. Explore the CPE Book Guide and Activities for more ways to use this book.

What are some ways you might use stories to inspire engineering experiences for the children in your setting?

Real-World Problem-Solving

Support children to identify problems in their schools, neighborhoods, or communities. Encourage them to brainstorm different solutions, create a plan or design, test their designs, and iterate as necessary. Here are a few examples:

Infants and toddlers:

- Imaginary play: The toy animals need shelter from a big rainstorm. Can you build a structure to protect them from the rain?
- A tool for reaching: Many crayons are lost under the cabinet. Create a tool that can reach underneath the cabinet to pull them out.

Preschoolers:

- The dolls in our dramatic play area do not have a space to sleep. What can we do to solve this problem?
- The cars in our block center need a garage to keep them safe. What can we build to help protect them?
- We need to water the plants in the classroom. What can we use or create to move water from one place to another?
- We have so many craft materials and coloring tools. Can you find a way to help us organize them?



(Examples for supporting children in problem-solving continue on the next page.)

Early elementary-aged children:

- Playground improvement: The playground needs a new feature that can be used by all children—even children in wheelchairs. Can you design a model of a playground that lets all children play?
- Engineering in the garden: There are numerous problems that can arise in a garden setting. Here are a few:
  - The birdseed in our bird feeder keeps getting wet in the rain. What might we do to the bird feeder to protect it from the rain?
  - The tomato plants in our garden are falling over. How might we help them stay standing up?
  - The birds keep eating all of the blackberries off of our bush. How might we keep the birds away from our berries?



- Insulation: The ice in my cup keeps melting. How might we design a solution to insulate my drink so the ice does not melt?

What are some real-world problems in your school, community, or learning setting that children might design and engineer solutions for? Who will benefit from the solutions that are created? Does the solution impact anyone or anything in a negative way?

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