**Embracing the ‘E’ in STEM/STEAM**

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**Engineering means we get to build something!!**

**\*\*I Can Hypothesize and Predict!**

* What can I build with these materials?
* What materials do I need to build what I want?
* How?
* What may (or may not) work?
* Record the hypothesis (optional)
* What materials?
* How will my project go together?
* Do I have enough materials?
* How many/much do I need?
* How high, long, or strong will it be?
* How long will it take?

**I can Organize, Plan and Do**

* Make sure materials are available and ready to go.
* Examine, explore, test and understand what works.
* Make adjustments to plan, if necessary.

**Conclude your project!**

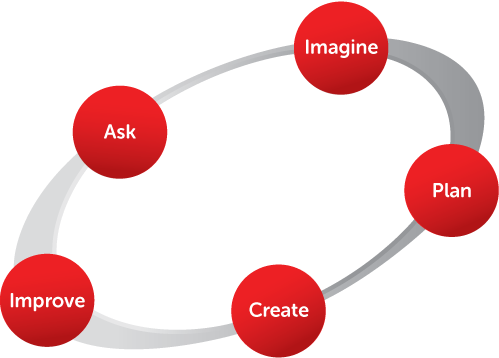
* What would you change?
* Can you extend the project and build more?
* Does it give you any more ideas?

# The Engineering Design Process

To solve engineering problems, engineers follow a series of steps called the “**Engineering Design Process.**”

## A Five-Step Process

Because the EiE Project serves young children, we’ve created a simple Engineering Design Process (EDP) to guide students through our engineering design challenges. This EDP has just five steps and uses terms children can understand.



**ASK:** What is the problem? How have others approached it? What are your constraints?

**IMAGINE:** What are some solutions? Brainstorm ideas. Choose the best one.

**PLAN:** Draw a diagram. Make lists of materials you will need.

**CREATE:** Follow your plan and create something. Test it out!

**IMPROVE:** What works? What doesn't? What could work better? Modify your design to make it better. Test it out!

It’s important to note that the EDP is flexible. There are as many variations of the model as there are engineers. With EiE, students work through all five steps, but in real life, engineers often work on just one or two steps, then pass their work to another team.

Note that the EDP is a cycle—there’s no official start or end point. You can begin at any step, focus on just one step, move back and forth between steps, or repeat the cycle. For example, after you improve your design once, you may want to begin all over again to refine your technology. You can use the EDP again and again!

**Engineering for Preschool**

Wee Engineer

* 1) Explore: find out more
* 2) Create: try and idea
* 3) Improve: make it better \*

Engineering Thoughts

* During **explore**, we can help children develop the ability to *hypothesize* and *predict.*
* Encourage the child to **create** and try an idea.
* Help the child use language as he/she thinks about how to **improve** the project.

\*Engineering is Elementary. 2017. “Engineering Design Process.”

Boston: Museum of Science.

**Developmentally Appropriate Block Play**

**Infants and Twos**

**What They Do**

* Manipulate/feel blocks with hands
* Put blocks in mouth
* Reach for blocks
* Drop blocks repeatedly, especially if in a high chair
* Knock down a stack of blocks
* Older infants (approximately 8-12 months) will look for a hidden block
* Toddlers love to stack big foam blocks as high as they can and knock them down

**What They Learn**

* Physical properties of objects
* Eye-hand coordination
* Lessons of gravity
* Cause and effect
* Object permanence

**What They Need**

* Lots of blocks in different shapes that they can grasp
* Soft vinyl-covered foam blocks that won't hurt when mouthed and can be washed after use
* Thin plastic or empty cereal-type boxes that can be knocked down
* Large, soft foam blocks for toddlers
* Medium-sized wood blocks in a variety of shapes and colors for toddlers

**Threes and Fours**

**What They Do**

* Match, group, and classify blocks by size, shape, and color
* Build tall stacks of blocks
* Build structures and roads
* Will start building without a design in mind, then label it afterward
* Make patterns with blocks
* Begin to use blocks in pretend play scenarios

**What They Learn**

* Beginning math concepts such as matching, grouping, classification
* Problem solving
* Fine motor and gross motor control
* Visual-spatial relations
* Balance and gravity
* The power of their imagination
* Confidence in their ability to create

**What They Need**

* Lots of different types of blocks: a good set of wood unit blocks including arches, pillars, ramps, and curves; large hollow blocks; small color cubes; interlocking blocks such as bristle blocks or snap blocks
* Props such as play animals, people, vehicles, trees to embellish pretend play

**Fives and Sixes**

**What They Do**

* Build elaborate structures; cities, roadways, castles, houses, etc.
* Think about and plan what they intend to build
* Use blocks to represent real-life places and things
* Build structures specifically for their pretend play scenarios
* Tell stories about their structures
* Build cooperatively with others
* Match, group, classify, and arrange blocks in patterns

**What They Learn**

* Mathematical concepts including classification, seriation, number, and spatial relations
* How to express ideas using symbols or pretend objects
* Communication skills
* Planning, follow-through, cause and effect

**What They Need**

* Many different types of blocks and materials, including miniature multicultural people, vehicles, mechanical items (pulleys, drawbridges, inclines)
* Wagons, buckets, platforms
* Large hollow blocks
* Lots of space and time for building

Excerpt from The Whole Child: Development Education for the Early Years and Early Childhood Settings and Approaches, by J. Hendrick, P. Weissman, 2006 edition, p. 65.

Resources:

Lindeman, K.W., M. Jabot, & M.T. Berkley. 2013. “The Role of STEM (or STEAM) in the Early Childhood Setting.” L.E., Cohen & S. Waite-Stupansky, 95-113. Cambridge, MA: Emerald.

Lindeman, K.W., E.M. Anderson. 2015. “Using Blocks to Develop 21st Century Skills.” *Young Children* 70 (1): 36-43.

Engineering is Elementary. 2015. “Engineering Design Process.” Boston: Museum of Science. <http://www.eie.org/overview/engineering-design-process>

<http://www.parentingscience.com/Lego-bricks-construction-toys-and-STEM-skills.html>

<http://www.education.com/reference/article/developmentally-appropriate-block-play/>

<http://www.communityplaythings.com/resources/articles/2005/block-play--math-and-literacy>