Teaching Engineering to Toddlers and Preschoolers

By Janelle Durham, MSW, Parent Educator, Bellevue College. gooddayswithkids.com, InventorsOfTomorrow.com

The title of this handout may have you wondering: "Who teaches ENGINEERING to little kids??? That's crazy!" So, we need to start by talking about what I mean by engineering: I think of it as hands-on problem-solving. Engineering is about seeing a problem, coming up with ideas for how to fix it, testing them out, and revising your plan till it's the best possible fix for a problem.

This approach can apply in literally any field. As adults, we do it all the time. Whether you are trying to perfect a recipe for chocolate chip cookies, or trying to figure out how to assemble a toy when the directions are missing, or notice the table you're working at is wobbling, or you're trying to figure out a better route to work to get around the construction on your normal route.

Some adults just keep living with a problem and don't see it as fixable. That must be depressing to feel so powerless!

Other adults just habitually keep their eyes out for how they can make things better. They notice not just the problems, but also the things that are working OK but could be better. They feel empowered to make changes to make things better. They have lots of experience using lots of different tools and processes and are good at being creative with combining those with available materials to solve almost any problem. They can feel competent and powerful. They actively work to make the world a better place.

If we want our child to be like that as an adult, then here's how we start now:

Choose More Open-Ended Toys

An open-ended toy doesn't do anything unless the child does something with them. Examples include blocks, art supplies, cardboard boxes, string and tape, sticks and rocks.

Closed-ended toys can only be played with in limited ways. For example, a Star Wars storm trooper action figure is closed-ended. Active toys are where the child presses a button then sits back and is entertained. The more active the toy, the more passive the child.

Having access to mostly open-ended toys encourages the child to be creative and active and interact with them in lots of different ways. Now, it's important for parents to know that young children may not instinctively know *how* to play with open-ended toys. You need to invest some time in teaching and modeling. Teach them how to build with blocks. Model gathering up plastic animals and using the blocks to build a zoo, or a home, or a castle. When your child is 2 years old, open-ended toys will feel like a lot more work for you as a parent! But, once they get the hang of this style of play, then your child will be better at self-entertaining from then on.

Child-Directed Free Play

If our children's hours are all scheduled into art class and music class and soccer class, and so on, they'll learn a lot of skills. But they won't learn creative, self-guided, innovative problem-solving. They have to have time for free play. During free play, they'll run into barriers that they have to get past – they may want to have their stuffed animal at the top of the slide and have to figure out how to get it there. Don't jump in to solve all their problems for them. (You can be nearby as a resource of ideas, to help them take their own ideas to the next level.)

When they're doing art, building or creating, the process is more important than the product!

Tinkering

Give them a challenge that's easy and engaging to solve, then encourage them to keep tweaking it to improve upon it. For example, challenge kids to launch a pompom into the air and give them various materials to try – such as making a simple catapult with a craft stick and a pencil as a fulcrum. Then we challenge them to launch it higher (or farther, or more accurately so it can hit a target, or to launch multiple pompoms at once.) They make a minor adjustment, test it, tweak it, test it again.

Or if they're already building a tower, challenge them to make it taller. Or make it stronger. Can it withstand a toy car crashing into it or a DIY wrecking ball?

Teaching Science Process Skills

Teach your child to think like a scientist with these core skills, which can be applied to *any* topic, even all the things you may not think of as "science" topics.

- Observation – Encourage them to use all their senses to explore their world. Encourage them to go into depth and look at the details. Touch it, smell it, taste it, shake it to see if it makes noise, turn it over to look at it from a different angle, fold it, wash it…
- Communication – Goes hand in hand with observation. Ask them questions, teach them vocabulary… when describing the color of a leaf: "Dark green or light green? Is it all one color or variegated? Is it shiny or dull? Look, it's the same color as my sweater."
- Measurement – Use rulers, scales, measuring cups and more for standard measures, plus have fun with non-standard measures. How many stuffed tigers tall is it?
- Classification – Any time you have four or more objects you can start sorting them into categories – how are they alike, how are they different, which one doesn't belong?
- Inference and Prediction – Encourage them to make educated guesses and test them.

Teaching Tool Use

Let your kids experience using a wide variety of tools to build their skills and their knowledge of what's possible. Over the course of the year in our preschool STEM class, the kids use:

- Markers, Pens, Crayons, Pastels, Chalk, Pencils, Paint, Paintbrushes, Paint Rollers, Hole Punches, Scissors, Compasses, Staplers, Brads, Paper Clips, Binder Clips, Clothespins, Rubber Bands, Tape, Glue, Glue Sticks, Glue Guns, Magnets, Velcro, String, Shovels, Trowels, Rakes, Scoops, Handy Scoopers, Tongs, Tweezers, Pipettes, Eye Droppers, Turkey Basters, Nuts, Bolts, Screws, Screwdrivers, Knives, Chisels, Wire Cutters, Wire Strippers, Egg Beaters, Spatulas, Fish Nets, Hand Drill, a toy Electric Drill / Driver, Auger, Conveyor Belt, Water Wheels, Pulleys, Levers, Wedges, Inclined Planes, Wheels and Axles, Gears, Pumps, Nutcrackers, Strainers, Sieves, Sifters, Salad Spinners, Record Players, Typewriters, Overhead Projectors, Sandpaper, Fans, Thermometers, Rolling Pins, Cookie Cutters, Pizza Cutters, Motors, LED lights, Electrical Circuits, Measuring Cups, Rulers, a Blood Pressure Cuff, a Mortar and Pestle, a Waffle Cookie Press, a Garlic Press, Hammers, Scales, and more!
- We've learned how to evaluate materials: what will float, what will fly in the wind, what is heavy, what is light, what is strong, what is fragile, how to build stronger structures, taller structures, something that is waterproof, something that will crash-proof an egg.

Learn More

- For tons of hands-on STEM activities for kids age 3 – 7: www.InventorsOfTomorrow.com
- Engineering Practices in Preschool www.naeyc.org/resources/pubs/yc/sep2018/design-process-engineering-preschool
- Children's Engineering Educators: http://www.childrensengineering.com/
- Wee Engineer – a preschool science curriculum - https://info.eie.org/wee-engineer