INSPIRE RESEARCH INSTITUTE FOR PRE-COLLEGE ENGINEERING

PURDUE UNIVERSITY

PROMOTES ENGINEERING THINKING & DESIGN

2016 Review

Engineering Gift Guide

Gift ideas that engage girls and boys in engineering thinking and design

PURDUE UNIVERSITY™

PURDUE ENGINEERING EDUCATION

INSPIRE Research Institute for Pre-College Engineering

To learn how these gifts support engineering thinking and design go to:

Inspire-purdue.org/EngineeringGiftGuide

Fostering Engineering Learning

We have played and read all of this year's gift submissions. Check out what has been selected and why. Read how our research's "lessons learned" can be applied at home.

Each year the INSPIRE Research Institute for Pre-College Engineering at Purdue University works hard to bring you gift ideas that will engage your child in engineering thinking and design. This year you will find 111 toys, games, books, and applications included in the Engineering Gift Guide. Every gift included has been reviewed by children, parents, engineers, and a panel of internal reviewers.

Like in years past, we have included short articles based on findings from INSPIRE's research. The articles contain information that can be easily applied at home, even if you do not purchase any of the items in the guide.

We have added a new feature to our website—a page with detailed review summaries about each gift included in the guide. Every review summary includes a short description of the gift and how it promotes engineering learning and the engineering thinking and design practices and skills children engage in when interacting with the gift. Also

included are the average overall ratings as well as examples of feedback from our children, parent, and engineer reviewers. Here is a peek at a few of our review summaries!

The Extraordinaires® Design Studio: Deluxe
Ages 10+ extraordinaires.com $39.95

The Extraordinaires® Design Studio: Deluxe is a single player or multiplayer game that challenges users to design an object for a larger-than-life client. Players pick a client, whose profile and interests are laid out on a card. After a client has been

chosen, players select an object card. This card lets the player know what their client needs designed for them. Players study their client card to learn more about who their client is, what their needs are, and the world they live in. Next they use what they learn to create a design plan on the provided idea pad. The game also includes research, design and improve cards to help players think of good questions throughout the design process. Once their designs are complete the players present them. Players are encouraged to use the feedback they receive to make improvements. The game also contains award cards that can be handed out whether you are playing alone or with others. The game leaves room for a great deal of creativity for players, but also provides loose guidelines to follow to give players a rough idea of how they should approach the problem.

This game requires players to critically and creatively think about the requirements of the objects they must draw and design. Players must take into consideration a variety of factors, including their client's needs, additional challenges presented on the character card, and the object's function. The wide variety of clients and objects to design allows for endless fun with tons of possible combinations.

▶ **Engineering thinking and design practices the gift encouraged children to do or learn about:** Define a problem, learn about the problem, ask questions, make observations, generate ideas, make improvements to the solution, communicate the solution, refine ideas, create a prototype or process, analyze the solution, redesign the solution, optimize the solution, recognize patterns

▶ **Engineering text or context explicitly provided:** A problem, a client, a user, constraints, criteria

▶ **Additional engineering thinking and design skills addressed:** Creative thinking, problem solving, design

▶ **Overall ratings:**
- Children 4.5
- Parents 4.5
- Engineers 4.3

Water Bears
All ages waterbearsgame.com $2.99

Water Bears is an application based game (App Store, Google Play) that teaches kids systems thinking and spatial reasoning as they guide colorful liquids through a three dimensional puzzle of pipes to fulfill characters' needs. This application features 50 different puzzles with a variety of challenges. Each puzzle encourages children to learn in a three dimensional environment, allowing them to visualize how objects interact and interconnect in space. The ideas of constraints and limitations exist as players are often restricted to the amount of piping allowed in order to achieve the water bears' requirements. Furthermore, there are many applications to math and science as players learn about systems management by using piping systems to distinguish between the mixing of colors and forcing the liquids to go to their desired location. Even the water bear characters are based off of real-life microscopic organisms!

▶ **Engineering thinking and design practices the gift encouraged children to do or learn about:** Learn about the problem, plan the solution, redesign the solution, make improvements to the solution, apply mathematics, apply science

▶ **Engineering text or context explicitly provided:** A problem, a client, criteria, constraints

▶ **Additional engineering thinking and design skills addressed:** Systems thinking, spatial reasoning, critical thinking, creative thinking, design, problem solving

▶ **Overall ratings:**
- Children 5
- Parents 4.5
- Engineers 4

Little Red Riding Hood Deluxe
Ages 4-7 smartgamesusa.com $24.99

Little Red Riding Hood Deluxe incorporates the familiar children's story *Little Red Riding Hood* into an engaging, yet challenging logic puzzle game. It provides appealing figurines, obstacles, track pieces, a graphic novel, and a puzzle guide with 48 different challenges. The challenges range in difficulty from easy to expert. Users will enjoy that the rules of completing the puzzles correspond with the storyline of the book. Players must use their spatial reasoning and logical thinking skills to find the correct path piece(s) to get Little Red Riding Hood to Grandmother's house, and in some scenarios, the wolf - who must get there first. Users must plan, test and refine their solution in order to complete each individual puzzle challenge. Young children are able to play independently on this game once the rules have been established. Solutions are easily checked by moving the figurines along the paths that have been made or by turning the page in the puzzle guide.

▶ **Engineering thinking and design practices the gift encouraged children to do or learn about:** Plan the solution, try the solution, test the solution, redesign the solution, refine the solution

▶ **Engineering text or context explicitly provided:** A problem, a user, criteria, constraints

▶ **Additional engineering thinking and design skills addressed:** Critical thinking, problem solving, spatial reasoning, logical thinking, trouble shooting

▶ **Overall ratings:**
- Children 4.7
- Parents 4.8
- Engineers 4

Sew Science Cuddly Critters
Ages 8+ smartlabtoys.com $19.99

Smart Circuits Ages 8+ smartlabtoys.com $49.99

Electronics Learning Circuits
Ages 8+ thamesandkosmos.com $49.95

Electronics Advanced Circuits
Ages 10+ thamesandkosmos.com $199.95

Electronic Snap Circuits® – 300 Experiments Ages 8+ snapcircuits.net

Parents as a Critical Influence

Different roles you can play to encourage your child's interest and learning in engineering.

Children spend most of their time outside of school at home, so as a parent you have the opportunity to make the largest impact on their development of critical thinking skills, their career choices and the development of concrete goals for the future. There are easy ways that you can take on different roles to help your child, no matter his or her age!

▶ **Be a Student Achievement Stimulus.** Enthusiastically support your child's learning, both in and out of the classroom. Work with them on homework assignments, but also try to find ways to expand on the skills they're learning in school. Play games with them that support engineering thinking and design and be able to draw their attention to what they are learning. Offer praise for good work in school and act as a resource to help guide them towards areas for improvement.

▶ **Be an Engineering Thinking Guide.** Provide the scaffolding your child needs to grasp new skills and ideas. While visiting a museum exhibit, going over homework, or reading a picture book together, draw attention to STEM and engineering concepts. One-on-one interactions allow for great conversations, for any age, about engineering thinking in everyday situations.

▶ **Be an Engineering Career Motivator.** Act as a role model for your child. When they have questions for you about different concepts, be willing to go out and investigate the answers with them. By not being intimidated by the things you don't know, you can be a good example of what it takes to pursue a career in engineering.

▶ **Be an Engineering Attitudes Builder.** Foster positive attitudes about engineering. Seek out resources, programs, and workshops to attend by yourself or with your child in order to gain new perspectives on engineering and STEM careers.

You have the potential to deeply impact your child's future, just by supporting them little by little each day.

Source: Yun, Juyeon, Monica Cardella, Şenay Purzer, and Ming-Chien Hsu "Parents' Roles in K-12 Education: Perspectives from Science and Engineering Education Research." In the Proceedings of the *American Educational Research Association* Annual Meeting, April 2010, Denver.

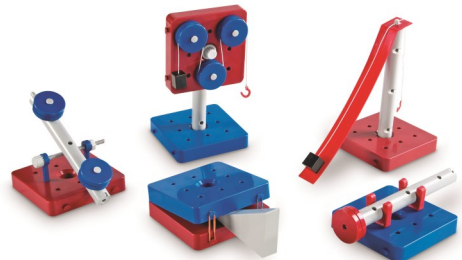**Tinker Crate - Trebuchet**
Ages 9-16+
kiwicrate.com
$16.95+/month

Tinker Crate - Rubber Band Car
Ages 9-16+
kiwicrate.com
$16.95+/month

Tinker Crate - Paper Circuits
Ages 9-16+
kiwicrate.com;
$16.95+/month

Tinker Crate – Automaton.
Ages 9-16+
kiwicrate.com
$16.95+/month

Simple Machines Set
Ages 10+
learningresources.com
$49.99

Simple Machines Activity Cards Set
Ages 10+ learningresources.com $17.99

STEM Classroom Bundle Ages 5+
learningresources.com $119.99

Switch & Spin Magnetic Gear Board Ages 2-4
melissaanddoug.com
$19.99

Amazing Animal Alphabet Puzzle Ages 5+
hapetoys.com $39.99

Pattern Blocks and Boards Classic Toy Ages 3-6
melissaanddoug.com $19.99

Pull Back Construction Vehicles Ages 9 months+ melissaanddoug.com $24.99

Double Loop Railway Set Ages 3+ hapetoys.com $99.99

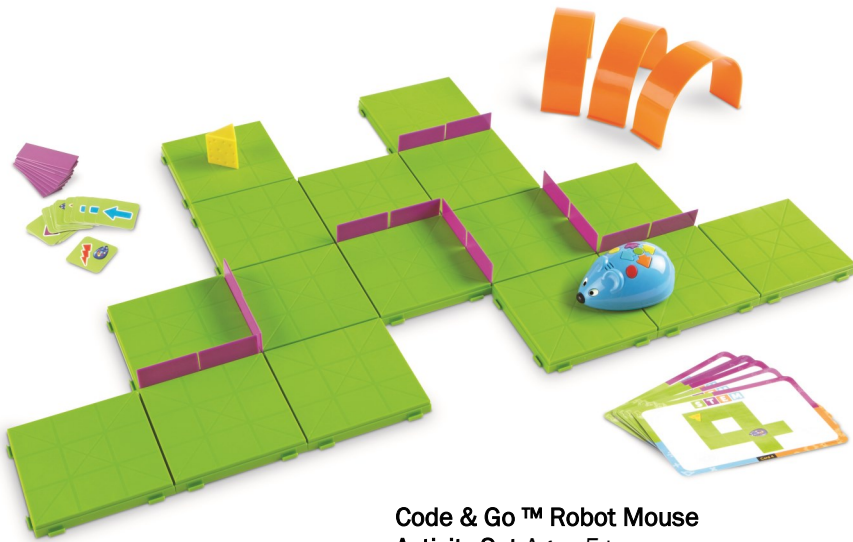**Home Sweet Home 3D Puzzle & Dollhouse In One** Ages 6+
melissaanddoug.com
$9.99

Magnetic Pattern Block Activity Set Ages 6+ learningresources.com $34.99

Medieval Castle 3D Puzzle & Play Set In One Ages 6+ melissaanddoug.com $9.99

Pretty Purple Dollhouse 3D Puzzle & Dollhouse In One Ages 6+ melissaanddoug.com $9.99

Code & Go ™ Robot Mouse Activity Set Ages 5+
learningresources.com
$59.99

Smartcar 5x5 Ages 4-9
smartgamesusa.com
$26.99

Kanoodle® Ages 7+
educationalinsights.com
$12.99

Architecto Ages 7+
foxmind.com $34.95

Code Master™ Ages 8+
thinkfun.com $19.99

IQ XOXO Ages 6+
smartgamesusa.com
$9.99

Dinosaurs - Mystic Islands
Ages 8+ smartgamesusa.com
$21.99

Penguins Pool Party Ages 6+
smartgamesusa.com $14.99

Laser Maze™ Ages 8+
thinkfun.com $29.99

Circuit Maze™ Ages 8+
thinkfun.com $29.99

Tumble Trax™ Magnetic Marble Run Ages 5+
learningresources.com $24.99
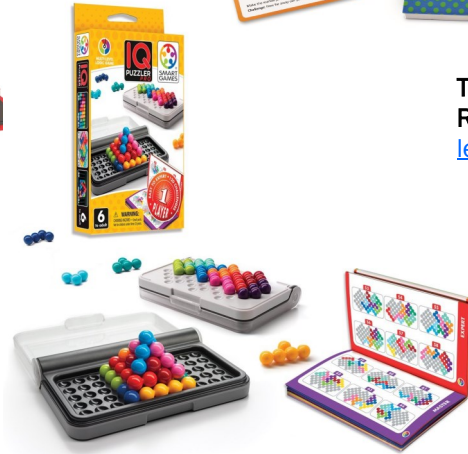
IQ Puzzler Pro Ages 6+
smartgamesusa.com
$9.99

Little Red Riding Hood Deluxe Ages 4-7
smartgamesusa.com
$24.99
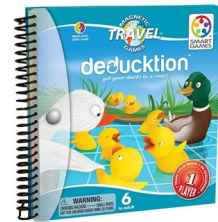
DeDucktion Ages 6+
smartgamesusa.com $9.99

Jungle – Hide & Seek Ages 7+
smartgamesusa.com $21.99

North Pole Expedition Ages 6+
smartgamesusa.com $21.99

Cobra Twist Ages 5+
smartzonegames.com $24.95

Kanoodle® Extreme Ages 8+
educationalinsights.com
$14.99

The Inclusion of Diverse Storybook Characters

Engineering-related children's books are useful tools for sharing positive messages about engineering. They help children to see characters as role models and develop strong perceptions of engineering as a possible future career.

Women, people with disabilities, Blacks, Latinas and American Indians are underrepresented in engineering fields in the United States. In order to increase underrepresented engineering degree recipients, it is necessary to provide opportunities for children to develop their self-concept and experience positive and effective pre-college engineering experiences.

In a recent study, Purdue researchers examined the portrayal of minorities, women, and people with disabilities in engineering-related children's books. Their findings demonstrated that the frequency of women and racial minorities represented in children's books are relatively higher than their participation in engineering fields. However, they still constitute smaller portions of the characters than men and represented populations. This finding suggests that even though children's literature publishers are paying good attention to these populations, a long journey is ahead in terms of providing equitable depictions. Meanwhile, the small number of characters with disabilities may call for publishers to create more characters with disabilities to remind all of us that people with disabilities engage in engineering. Children's books represent a medium that is addressing more equal representation of people from diverse backgrounds in the world of engineering.

▶ **Parent takeaway** Exposing your child to more engineering-related children's books, especially with a character that has the same gender, race, or disability, may increase the likelihood of your child seeing him or herself capable of being an engineer and choosing engineering as his or her career path.

Source: Ehsan, Hoda, Xinrui Xu, and Monica Cardella "Representation of Underrepresented Characters in Engineering Children Books" in the *Proceedings of the 46th ASEE/IEEE Frontiers in Education Conference*, Erie, PA. October 2016.

You Can Count on Me! I'm Ziva Marie! Ages 6-9
icanbeanengineer.com
$10.95
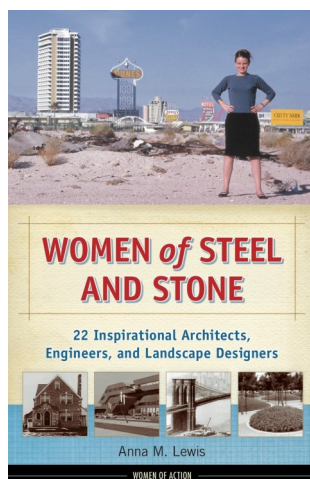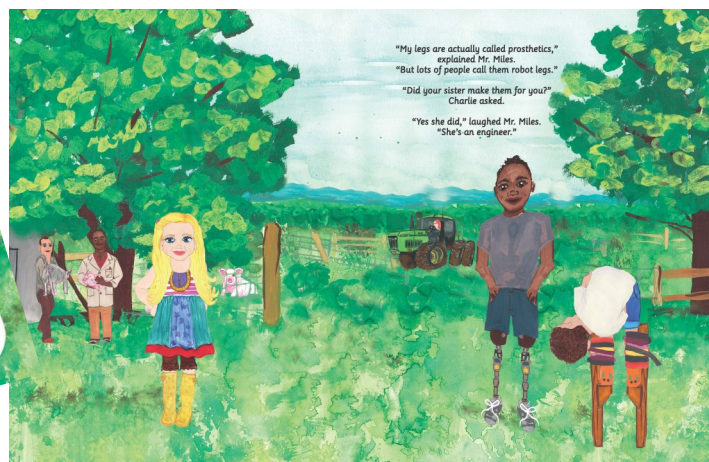
Women of Steel and Stone: 22 Inspirational Architects, Engineers, and Landscape Designers by Anna M. Lewis Ages 12-17
chicagoreviewpress.com
$19.95

_____'s Little Book of Dreams Ages 4-8
custemized.org $29.99

Gabriel was the oldest by two months, seventeen days, six hours, and three minutes. That made him the leader. He loved animals, big and small, and was fascinated by dinosaurs. If you had a question about dinosaurs, he could answer it quicker than you could say "Stegosaurus."

Laura was the team's engineer. It was hard inventing mechanical devices when you're only eight—Newtonburg

Home Improvement Depot doesn't exactly sell power tools to second graders. But Laura had a knack for making things work with rope, tape, bubble gum, and a bit of imagination.

And Cesar was the group's historian. He had a photographic memory and could remember all the dates, names, and facts from the page of a book simply by
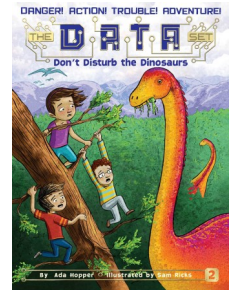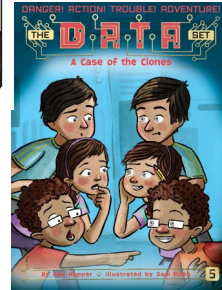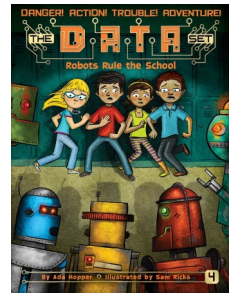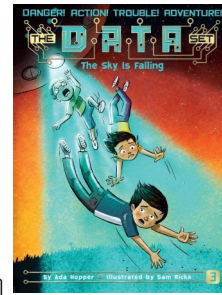
March of the Mini Beasts (The DATA Set— Book 1) by Ada Hopper Ages 5-9 simonandschuster.com $5.99

Don't Disturb the Dinosaurs (The DATA Set— Book 2) by Ada Hopper Ages 5-9 simonandschuster.com $5.99

The Sky is Falling (The DATA Set—Book 3) by Ada Hopper Ages 5-9 simonandschuster.com $5.99

Robots Rule the School (The DATA Set— Book 4) by Ada Hopper. Ages 5-9 simonandschuster.com $5.99

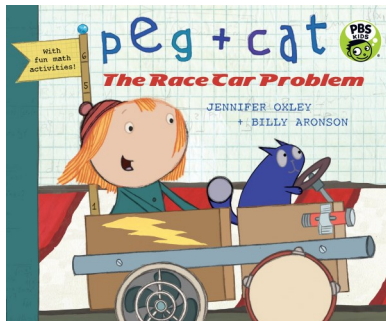*A Case of the Clones* (The DATA Set— Book 5) by Ada Hopper Ages 5-9 simonandschuster.com $5.99
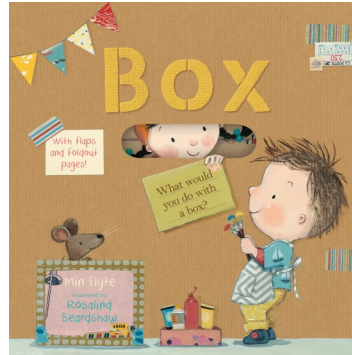
Box by Min Flyte Ages 3-7 candlewick.com $15.99

Peg + Cat: The Race Car Problem by Jennifer Oxley, Billy Aronson Ages 3-7 candlewick.com $12.99

Peg + Cat: The Penguin Problem by Jennifer Oxley, Billy Aronson Ages 3-7 candlewick.com $12.99

The Marvelous Thing That Came from A Spring: The Accidental Invention of the Toy that Swept the Nation by Gilbert Ford. Ages 4-8 simonandschuster.com $17.99

But how did the loom know which pattern to weave? That was the amazing part. The design was translated into a pattern of holes punched into heavy paper cards. Long chains of these cards were fed into the loom, giving it instructions. To change the design, you only had to change the cards. Ada was amazed. It was a brilliant idea—and not just for weaving cloth.

Why not use punched cards to direct other machines for other purposes?

Ada was onto something. Soon she would see how right she was.

Ada Lovelace, Poet of Science: The First Computer Programmer by Diane Stanley Ages 4-8 simonandschuster.com $17.99

Walls & Warriors Age 8+
smartgamesusa.com
$21.99

Create-a-Maze™ Ages 5+
learningresources.com
$29.99

Ghost Hunters Ages 6+
smartgamesusa.com
$14.99

Balance Beans Ages 5+
thinkfun.com $17.99

Pirates Jr. Hide & Seek Ages 6+
smartgamesusa.com $14.99

Kanoodle® Genius Ages 8+
educationalinsights.com
$12.99

Parking Puzzler Ages 7+
smartgamesusa.com
$14.99

Anti-Virus Mutation Ages 7+
smartgamesusa.com $14.99

Gravity Maze™ Ages 8+
thinkfun.com $ 29.99

Robot Engineer Ages 3+
thamesandkosmos.com
$49.95

Amusement Park Engineer Ages 3+
thamesandkosmos.com $69.95

**Grippies® Builders –
20 pc. Set** Ages 18 mos.+
guidecraft.com $39.99

Automobile Engineer
Ages 3+
thamesandkosmos.com
$49.95

Candy Construction™ Ages 4+
learningresources.com $24.99

**Gears! Gears! Gears!® 60-Piece
Starter Building Set** Ages 3+
learningresources.com $34.99

Quadrilla Space City Ages 6+
hapetoys.com $149.99

Dream Builder™ Set Ages 3-103
mypanelcraft.com $119.00

**MiO Playing Eating Sleeping
Working + 2 people** Ages 3+
manhattantoy.com $100.00

Bloxels Video Game Builder Kit Ages 8+ bloxelsbuilder.com $49.95

Water Bears Age 4+ waterbearsgame $2.99

Pettson's Inventions Ages 6-9 filimundus.com $2.99

Pettson's Inventions 2 Ages 6-9 filimundus.com $2.99
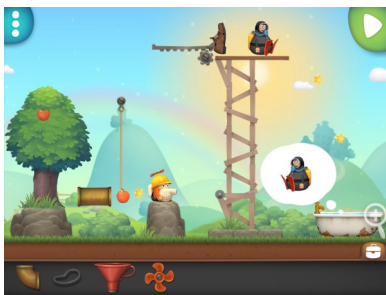
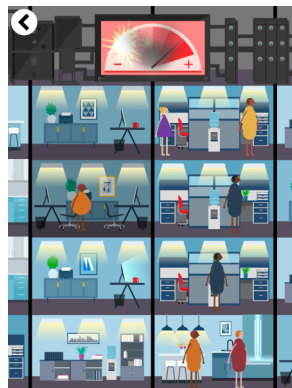**Inventioneers - Full Version** Ages 9-11 filimundus.com $2.99
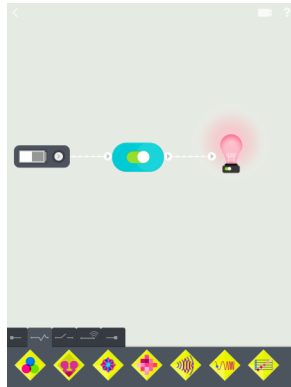
The Everything Machine Ages 6-8 tinybop.com $2.99
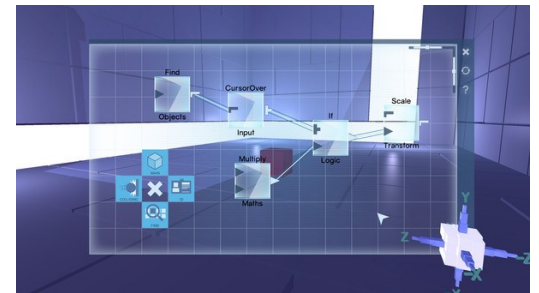
Glitchspace Ages 10+ glitchspace.com $12.99
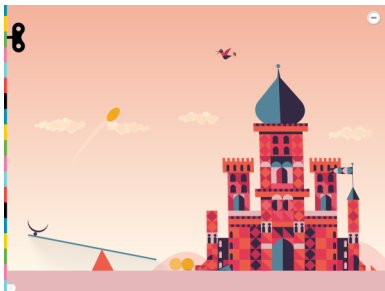
Simple Machines Ages 6-8 tinybop.com $2.99

Skyscrapers Ages 6-8 tinybop.com $2.99

Osmo Coding Ages 5-12 playosmo.com $49.00

IO Blocks® 192 Piece Set Ages 4+ guidecraft.com $59.95

The Humanistic Side of Engineering

Engineering work involves working with and for other people. The development of communication, collaboration, and presentation skills should begin in childhood. How are these skills being promoted at school and what can you do with your child at home?

At school. Within classrooms, these skills are being promoted through various innovative activities. Students are assessing the unique needs of smaller communities, such as their school, creating solutions for book characters, and working together with classmates on simple design projects.

At home. It's easy to provide opportunities for children to practice humanistic skills at home.

▶ **The next time you and your child read a book**, draw connections between the characters and possible problems that can be solved.

▶ **Involve your child in simple decisions around the home**, like how to best organize their toys, to give them practice in communicating ideas.

▶ You can encourage a deeper understanding of diverse contexts every day by exposing them to different cultures and ideas.

The gifts in this guide can help, too!

▶ **To boost good teamwork skills**, try multiplayer games such as Engineering Ants, where children are required to work with others to reach a common goal.

▶ The Extraordinaires: Design Studio offers a wide variety of ways for children to **investigate different contexts** as they design solutions for people's diverse needs.

▶ Building kits, including Geomag and Brackitz, offer children the space to **creatively consider different contexts, clients, and constraints**.

These ideas can help your child develop into a well-rounded individual, no matter what field they choose to pursue in the future, but especially for those with engineering dreams!

Geomag Glow 104 Ages 3+ geomagworld.com $79.99

Geomag Black & White 104 Ages 5+ geomagworld.com $69.99

Brackitz Driver 43 Piece Set Ages 4+ brackitz.com $24.99

Brackitz Creator 42 Piece Set Ages 3+ brackitz.com $29.99

Brackitz Inventor 100 Piece Set Ages 3+ brackitz.com

Arckit Go Colours
Ages 10+ arckit.com
$59.99

Arckit A180 Ages 14+
arckit.com $189.99

Arckit Go Plus Ages 12+
arckit.com $59.99

Arckit A90 Ages 14+
arckit.com $99.99

Remote-Control Machines:
Custom Cars Ages 8+
thamesandkosmos.com
$99.95

Geckobot Ages 8+
thamesandkosmos.com
$49.95

Gyroscopes & Flywheels Ages 8+

Deluxe Snap Rover ® Ages 8+
snapcircuits.net $119.95

Ruby Rails Skydive
Action Figure Ages 4+
goldieblox.com
$24.99

GoldieBlox Zipline Action
Figure Ages 4+
goldieblox.com $24.99

Val's Level-Up Skate Park
Ages 6+ goldieblox.com
$14.99

Li's Lighthouse Lookout
Ages 6+ goldieblox.com
$14.99

ThinkFun, Inc. Maker Studio™:
Gears Set Ages 7+
thinkfun.com $19.99

Invention Mansion Ages 6+
goldieblox.com $59.99

Blocks—30th Anniversary Limited
Edition Ages 12 months+
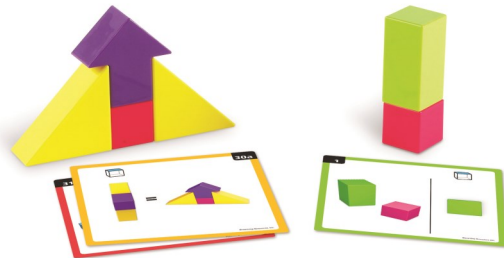hapetoys.com $24.99
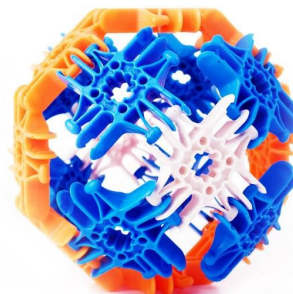
Lux Small 88 Piece Set Ages 6+
luxblox.com $29.99

Maze Racers Game
Ages 8+ foxmind.com
$39.95

Peaceable Kingdom Engineering Ants Ages 5+
peaceablekingdom.com $19.99

RiddleCube™ The Game
Ages 8+
educationalinsights.com
$19.99

Mental Blox 360° 3-D Building Game Ages 5+
learningresources.com $29.99

Mental Blox Game Ages 5+
learningresources.com $29.99
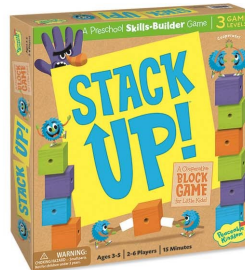
Peaceable Kingdom Stack Up!
Ages 3-5 peaceablekingdom.com
$19.99

The Extraordinaires® Design Studio: Deluxe Ages 10+
extraordinaires.com $39.95

iTrax™ Game Ages 6+
learningresources.com $19.99