2017 Review

Engineering Gift Guide

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

PROMOTES ENGINEERING
THINKING & DESIGN

INSPIRE RESEARCH INSTITUTE FOR PRE-COLLEGE ENGINEERING
PURDUE UNIVERSITY

PURDUE UNIVERSITY

INSPIRE
Research Institute for Pre-College Engineering

To learn how these gifts support
engineering thinking and design go to:
purdue.edu/INSPIRE/EngineeringGiftGuide

The INSPIRE Research Institute for Pre-College Engineering is a center in the School of Engineering Education at Purdue University focused on pre-college engineering education research and integration of engineering with science, technology, mathematics, computational thinking and literacy. INSPIRE is composed of 15+ faculty, staff, and postdoctoral researchers and 40+ graduate and undergraduate research assistants on a mission to study pre-college engineering experiences and environments in order to impact educational systems. You can learn more about INSPIRE and its work at **engineering.purdue.edu/INSPIRE**.

WHY DOES WHAT WE DO MATTER?

We know not every child will grow up to be an engineer; however, our research and work impacts children by:
- providing opportunities for them to apply their abilities to solve meaningful real-world challenges
- teaching them vital problem solving and technical skills, to prepare them for future success, no matter their profession
- educating them about the nature of engineering, so they have a better understanding of what an engineering career might hold for them

WHY WAS THE GIFT GUIDE CREATED?

"STEM learning" has become a buzzword today in education and children's media, which makes it all the more confusing to sort out which products can teach STEM concepts - particularly engineering. As a leader in engineering education, we assist parents, educators, and gift givers by publishing the Engineering Gift Guide, in an effort to inform them about which toys, games, books, and apps successfully promote engineering thinking and design to girls and boys ages 3-18.

WHAT IS OUR REVIEW PROCESS?

Companies and publishers choose to submit toys, games, books, and apps for evaluation by INSPIRE. These submissions are reviewed by INSPIRE's team, outside engineering/STEM experts, parents, and children. This happens not only in the lab, but also in homes and at events we host throughout the Purdue University campus and the Greater Lafayette community. Gifts receive feedback about whether or not they promote engineering thinking and design, and are rated on their value, fun factor, potential for educational impact, and usability. Altogether, this feedback determines which toys, games, books, and apps are included in the Engineering Gift Guide.

There are no fees for companies and publishers to submit their products to our guide. INSPIRE does not make or sell any of the products featured in the guide, nor does it receive any funds to advertise or promote any of the products included in the guide or on their website. Purdue University does not endorse such products contained herin, but only recommends them solely due to their engineering education value.

CONCEPT KEY:
This key, placed throughout the guide, signifies the top two STEM concepts that we feel each item best teaches.

C/P - Coding/Programming	**CriT -** Critical Thinking	**LT -** Logical Thinking	**PS -** Problem Solving
CT - Computational Thinking	**D -** Design	**M/S -** Apply Math/Science	**SR -** Spatial Reasoning
CreaT - Creative Thinking	**EDP -** Engineering Design Process	**P -** Perseverance	**WC -** Work Collaboratively

3+ **C/P, SR** **Bee-Bot** bee-bot.us $89.95

3+ **C/P, SR** **Blue-Bot** bee-bot.us $119.95

3+ **C/P, SR** **Pro-Bot** bee-bot.us $149.95

3+ **C/P, SR** **TacTile Reader** bee-bot.us $129.95

3+ **C/P, CT** **COZMO + Code Lab** anki.com $179.99

5+ **C/P, D** **Thymio Robot** techykids.com $199.00-235.00

5+ **C/P, D** **Meeper BOT 2.0 + Coding App** meeperbot.com $54.99

6+ **C/P, CreaT** **Coding Jam** playosmo.com $59.00

8+ **LT, CT** **CODE Robot Repair** thinkfun.com $14.99

8+ **LT, CT** **CODE Rover Control** thinkfun.com $14.99

10+ **C/P, PS** **CoDrone Lite** robolink.com $119.99

10+ **C/P, EDP** **CoDrone Pro** robolink.com $179.99

12+ **C/P, EDP** **SHENZHEN I/O** zachtronics.com $14.99

LOGIC & PUZZLE

C/P - Coding/Programming
CT - Computational Thinking
CreaT - Creative Thinking
CriT - Critical Thinking
D - Design
EDP - Engineering Design Process
LT - Logical Thinking
M/S - Apply Math/Science
P - Perseverance
PS - Problem Solving
SR - Spatial Reasoning
WC - Work Collaboratively

2+
SR, CreaT
Magik Play Starter Kit
magikbee.com
$57.99

3+
EDP, SR
Q-bitz Jr.
mindware.com
$19.95

4+
LT, SR
Mental Blox Jr. Early Logic Game
learningresources.com
$19.99

7+
LT, SR
Jump'IN
smartgamesusa.com
$21.99

8+
LT, SR
Dr. Beaker
blueorangegames.com
$19.99

8+
LT, SR
Dr. Eureka
blueorangegames.com
$19.99

4+
LT, SR
Snow White
smartgamesusa.com
$26.99

5+
EDP, CreaT
Thinkrolls Kings & Queens
avokiddo.com
App Store $3.99,
Google Play FREE,
Amazon $2.99

6+
M/S, CriT
Gravity's Edge
mindware.com
$24.95

8+
LT, CriT
Lunar Landing
thinkfun.com
$14.99

8+
CriT, LT
Dr. Microbe
blueorangegames.com
$19.99

8+
LT, PS
Clue Master
thinkfun.com
$9.99

6+
LT, CriT
Roller Coaster Challenge
thinkfun.com
$24.99

6+
LT, SR
Go Go Gelato!
blueorangegames.com
$19.99

7+
LT, SR
Temple Connection
smartgamesusa.com
$21.99

8+
LT, P
Wave Breaker
thinkfun.com
$19.99

8+
LT, P
Color Cube Sudoku
thinkfun.com
$19.99

8+
LT, SR
IQ Focus
smartgamesusa.com
$9.99

ENGINEERING THINKING

What our experts say it is: "Engineering thinking involves using evidence to make decisions and recommendations to create products, processes or improvements to benefit people. This is often done as part of a team made up of people with diverse perspectives, backgrounds and skill sets."

How this applies to the gifts we review: When reviewing submissions, we look for products that teach or reinforce engineering habits of mind (such as perseverance, learning from failure, and the application of mathematics and science to everyday problems) and critical thinking skills (such as applying evidence to decision-making, or evaluating how well solutions address the constraints of the problem) that engineers commonly use as they solve problems.

An example of a toy that promotes engineering thinking:
Learning Resources ® City Engineering & Design Building Set fosters children's engineering thinking skills as they find solutions to a variety of challenges. Learning Resources® City Engineering & Design Building Set is a toy for children 5 and older that includes building pieces and ten engineering activity cards. Cards one through five provide pictorial instructions for building a structure, plus icons and text for parents to use to help their children "think like an engineer" to solve a problem. In activity one, children build a bridge and then redesign the bridge so that a large boat can pass through the center. Children use several crucial engineering concepts when playing with the toy:

- **Applying past knowledge to solve problems.** Children apply their previous knowledge of bridges, boats, moving components, building structures, etc. to solve the problem.
- **Using creative and innovative problem solving.** Children imagine and record multiple possible solutions to the problem.
- **Communicating effectively.** Children have multiple opportunities to explain and justify their thinking and choices.

ENGINEERING DESIGN

What our experts say it is: "Engineering design is an iterative process of developing a problem definition while also developing solutions, where the problem definition and possible solutions inform and change each other. The process leads to a product, process or improvement, and is often done collaboratively."

How this applies to the gifts we review: When we write reviews, we look for gifts that encourage children to apply their design skills and practices to identify and learn about the problem and plan, develop, test, and implement their solutions.

An example of a toy that promotes engineering design: Tinkering Labs™ Electric Motors is a kit that prompts children 8 and older to complete design projects that utilize the power of electric motors. Inside the kit are challenge cards that engage children in open-ended tasks like "Make a ride for one of your toys." The challenge allows children to think about what problem they want to address (What toy will I build a ride for? What kind of ride can I build with the materials I have? How will I know if I have created a successful ride for my toy?) and figure out what they will need to learn about (How will I get my wheels to spin? What solutions have others used to solve the problems I'm having? How will I use this information to create a solution?). Children solve the challenge as they generate ideas, build, test, and make improvements to their design solution.

Ada's Ideas: The Story of Ada Lovelace, the World's First Computer Programmer
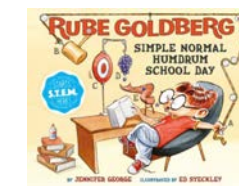by Fiona Robinson
abramsbooks.com
$17.95
6+
P, C/P
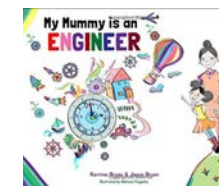
My Mummy is an Engineer
by Kerrine Bryan & Jason Bryan
butterlybooks.uk
$6.99
4+
D, M/S

Rosie Revere's Big Project Book for Bold Engineers
by Andrea Beaty
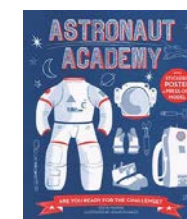abramsbooks.com
$14.95
5+
EDP, CreaT

Rube Goldberg's Simple Normal Humdrum School Day
by Jennifer George
abramsbooks.com
$17.95
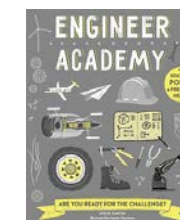**5+**
D, CreaT

Iggy Peck's Big Project Book for Amazing Architects
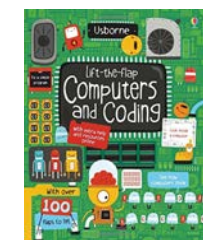by Andrea Beaty
abramsbooks.com
$14.99
5+
EDP, CreaT

Astronaut Academy
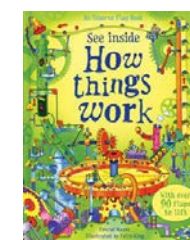by Kane Miller
myubam.com
$12.99
7+
PS, WC

Engineer Academy
by Kane Miller
myubam.com
$12.99
7+
EDP, M/S

Lift-the-flap Computers and Coding
myubam.com
$14.99
7+
C/P, CT

See Inside How Things Work
myubam.com
$14.99
7+
D, PS

Coding for Beginners Using Python
myubam.com
$14.99
7+
C/P, CreaT
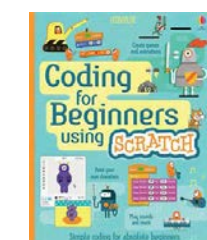
Coding for Beginners Using Scratch
myubam.com
$14.99
7+
C/P, CreaT

C/P - Coding/Programming
CT - Computational Thinking
CreaT - Creative Thinking

CriT - Critical Thinking
D - Design
EDP - Engineering Design Process

LT - Logical Thinking
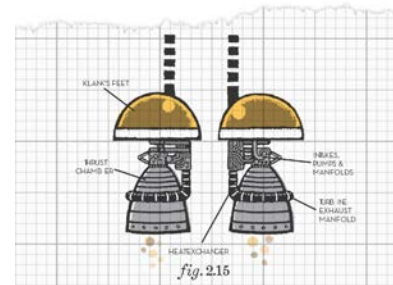**M/S** - Apply Math/Science
P - Perseverance

PS - Problem Solving
SR - Spatial Reasoning
WC - Work Collaboratively

Frank Einstein and the Antimatter Motor (#1)
Frank Einstein and the Electrofinger (#2)
Frank Einstein and the Brain Turbo (#3)
Frank Einstein and the Evoblaster Belt (#4)
Frank Einstein and the Bio-Action Gizmo (#5)
Frank Einstein and the Space-Time Zipper(#6)
by Jon Scieszka
abramsbooks.com
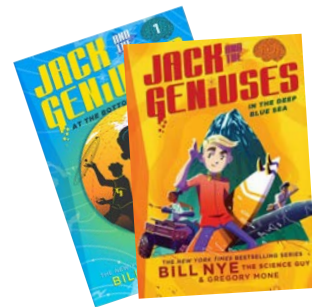$7.95 paperback, $13.95 hardcover
8+
EDP, WC

STEM Perplexors: Basic Level (age 8-9)
STEM Perplexors: Level A (age 9-10)
STEM Perplexors: Level B (age 10-11)
STEM Perplexors: Level C (age 11-12)
STEM Perplexors: Level D (age 12+)
mindware.com
$12.95 each, $44.95 set of 5
8+
LT, P

Jack and the Geniuses
At the Bottom of the World (#1)
Jack and the Geniuses
In the Deep Blue Sea (#2)
by Bill Nye & Gregory Mone
abramsbooks.com
$13.95 each
8+
WC, M/S
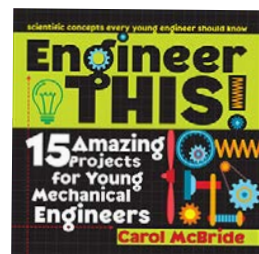
Engineer THIS!: 10 Amazing Projects for Young Mechanical Engineers
by Carol McBride & Francisco L Gonzales
prufrock.com
$14.95
9+
EDP, PS

The Story of Inventions
myubam.com
$10.99
8+
EDP, P

Curly Bracket - The Hidden Code
curlybracket.com
$11.01 (e-book)
$20.68 (hardcover)
8+
CT, P

This is Not a Math Book
This is Not Another Math Book
myubam.com
$14.99 each
9+
M/S, CreaT

GearZooz Roll & Roar Animal Train
vtechkids.com
$29.95
1+
SR, CreaT

Grippies Links - 16 pc.
guidecraft.com
$39.95
1.5+
CreaT, SR

Little Cruisers Build & Spin
learningresources.com
$19.99
2+
SR, CreaT

Gears! Gears! Gears!® Robot Factory Building Set
learningresources.com
$39.99
3+
SR, CreaT

Magicube Polar Animals
geomagworld.com
$31.17
1.5+
SR, D

1-2-3 Build It!
Car - Plane - Boat
learningresources.com
$19.99
2+
SR, PS

Magicube Robots
geomagworld.com
$39.70
3+
D, CreaT

Joinks - 79 pc.
fatbraintoys.com
$44.95
3+
SR, CreaT

Magicube Safari Park
geomagworld.com
$39.70
1.5+
SR, D

Better Builders Reflections - 29 pc.
guidecraft.com
$49.95
2+
CreaT, SR

Magicube Castles & Homes
geomagworld.com
$49.63
3+
D, CreaT

Boat Engineer
thamesandkosmos.com
$49.95
3+
SR, CreaT

3+ **D, CreaT**
Magformers Rainbow - 30 pc. set
magformers.com
$49.99

3+ **D, CreaT**
Magformers Curve - 20 pc. set
magformers.com
$39.99

4+ **SR, CreaT**
Bamboo Builder Marble Run - 119 pc.
fatbraintoys.com
$89.95

4+ **D, CreaT**
Basic Building Box - 106 pc.
hubelino.com
$89.99

4+ **D, CreaT**
Brackitz Bugz Playpark - 47 pc.
brackitz.com
$29.99

4+ **D, SR**
Brackitz Pulleys - 77 pc.
brackitz.com
$39.99

4+ **SR, D**
Gears! Gears! Gears!® Rover Gears
learningresources.com
$14.99

4+ **SR, CreaT**
Gears! Gears! Gears!® Space Explorers Building Set
learningresources.com
$39.99

4+ **CreaT, SR**
People Blocks - 31 pc.
peopletoy.co
$59.99

5+ **SR, CriT**
KEVA Brain Builders Junior
mindware.com
$14.95

5+ **CreaT, SR**
IO Blocks Minis - 250 pc.
guidecraft.com
$29.99

ONE CHILD AT A TIME

Even though progress has been made in terms of inclusiveness within engineering, data show that there is still much to be done. INSPIRE researchers have found that demonstrating connections between your child's interests and engineering, while emphasizing how engineers contribute to society can help extend what they know and correct any misconceptions they may have about the field.

Try the following to extend your child's perceptions of engineering and engineers:

AVOID DIRECTIONS; ASK QUESTIONS INSTEAD
Let your child take charge and boost their confidence in their abilities, especially in young girls. Ask questions such as: How might we do X? Why did you put X there? and What should we do next?

ADD CONTEXT TO TOYS AS YOU AND YOUR CHILD PLAY
If a toy does not offer a context, provide one yourself! Ask your child to design a solution for someone else. Favorite characters, animals, or family members are all great options!

POINT OUT THE HUMAN IMPACT OF ENGINEERING
Go beyond just pointing out the products engineers were involved in creating. Talk to your child about the way engineers have made people's lives easier and safer. Point out commonplace things (running water, electricity) and incredible feats (sending people to space, wind turbines harvesting energy).

SEEK OUT EXAMPLES OF DIVERSITY
Educate yourself and your child about the accomplishments of diverse engineers. Read books about diverse women who have amazing careers in engineering. Lookup engineers working around the world in different countries and for different purposes.

Sources: Rush, J. D., & Hira, A., & Hynes, M. M. (2017, June), The Role of Gender in Pre-college Students' Perceptions of Engineering Paper presented at *2017 ASEE Annual Conference & Exposition*, Columbus, Ohio.

Hynes, M., Joslyn, C., Hira, A., Holly Jr., J, Jubelt, N. (2016). Exploring diverse pre-college students' interests and understandings of engineering to promote engineering education for all. *International Journal of Engineering Education*.

5+ **D, CreaT**
Space Truck
geosmart.eu
$69.99

5+ **D, CreaT**
Starship
geosmart.eu
$59.99

5+ **D, CreaT**
Moon Lander
geosmart.eu
$49.99

5+ **D, CreaT**
Lunar Rover
geosmart.eu
$49.99

BUILDING

C/P - Coding/Programming
CT - Computational Thinking
CreaT - Creative Thinking
CriT - Critical Thinking
D - Design
EDP - Engineering Design Process
LT - Logical Thinking
M/S - Apply Math/Science
P - Perseverance
PS - Problem Solving
SR - Spatial Reasoning
WC - Work Collaboratively

5+ **GeoSpace Station**
D, CreaT
geosmart.eu
$90.79

5+ **Alien Creatures**
D, CreaT
geosmart.eu
$99.99

5+ **PowerClix Construction Vehicle Set**
CreaT, SR
guidecraft.com
$60.00

5+ **Tree House Engineering & Design Building Set**
EDP, SR
learningresources.com
$16.99

5+ **Playground Engineering & Design Building Set**
EDP, SR
learningresources.com
$24.99
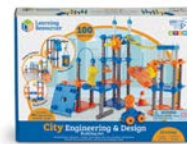
5+ **City Engineering & Design Building Set**
EDP, SR
learningresources.com
$24.99
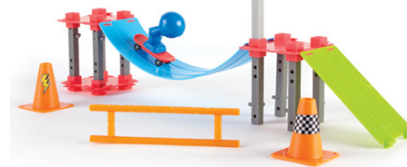
5+ **Skate Park Engineering & Design Building Set**
EDP, SR
learningresources.com
$16.99

6+ **Q-BA-MAZE 2.0 RAILS**
SR, PS
mindware.com
$59.95

6+ **Q-BA-MAZE 2.0 STUNTS**
SR, PS
mindware.com
$79.95

6+ **The OffBits - CareBit**
SR, CreaT
fatbraintoys.com
$14.95

6+ **The OffBits: Vehicle - Red**
SR, CreaT
fatbraintoys.com
$14.95

7+ **Mechanical Engineering: Robotic Arms**
SR, M/S
thamesandkosmos.com
$59.95

7+ **KEVA Brain Builders**
SR, CriT
mindware.com
$14.95

7+ **KEVA Contraptions - 200 pc.**
EDP, SR
mindware.com
$19.95

8+ **Structural Engineering: Bridges & Skyscrapers**
SR, M/S
thamesandkosmos.com
$49.95

8+ **Geomag Pro-L - 110 pc.**
D, CreaT
geomagworld.com
$71.99

8+ **Flexo Beginners Pack**
D, CreaT
flexo.nz
$23.82

8+ **Flexo Standard Pack**
D, CreaT
flexo.nz
$53.62

9+ **Marbleocity Mini Coaster**
SR, CriT
tinkineer.com
$29.99

12+ **Marbleocity Dragon Coaster**
SR, CriT
tinkineer.com
$59.99

12+ **Propulsion Rocket**
EDP, WC
discoverykids.com
$19.99

THAT CAN HELP YOUR CHILD BECOME A BETTER PROBLEM SOLVER

Although computational thinking may bring to mind computers and coding, a broader definition defines it as a problem-solving process with overlap in engineering and mathematical thinking. This ability is relevant in any field, and it is becoming increasingly essential as our world becomes more tech-based and computer-oriented. The next time your child is solving a social, academic or play-related problem, pay attention to how he or she goes about finding a solution. Use the tips and questions below to help your child develop new ways of approaching problems in his or her world!

PROBLEM DECOMPOSITION: Dividing the problem into smaller, more manageable parts
When tackling a complex problem encourage your child to break it down into small decisions and steps. Ask questions such as: "What do we do first?", "Who should do what?", and "Where should we start?"

ABSTRACTION: Reducing the complexity of the problem
Encourage your child to simplify problems by focusing only on the most important aspects. Looking at the problem in its simpler form will help your child make connections to their previous experiences and day-to-day observations. After making those connections, urge him or her to form general rules and concepts that can be used repeatedly when problem solving or completing a task

PATTERN RECOGNITION: Observing patterns, trends and regularities in data
Have your child find similarities (features, processes, data, etc.) between the current problem and problems they've seen in the past. Doing this connects your child's previous knowledge to the problem at hand. Ask your child questions like "What do all of these things have in common?" and "How are these pieces related to each other?"

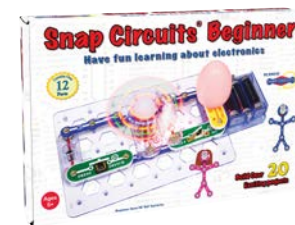**SIMULATIONS: Developing a model to imitate natural and artificial processes**
Encourage your child to create a working model to try a solution. Ask questions like, "How can we model our solution to test it?" or "What characteristics or abilities does the model need?"

DEBUGGING: Identifying and addressing problems that prevent the task from being completed
Have your child step back and look for issues within the solution. Encourage your child to address any problems head-on. Let them know that it is okay to make changes when necessary!

Source: Ehsan, H., & Cardella, M. E. (2017, June), Capturing the Computational Thinking of Families with Young Children in Out-of-School Environments Paper presented at 2017 ASEE Annual Conference & Exposition, Columbus, Ohio

Let's Go Code!
learningresources.com
5+ C/P, CT $34.99

Coding Farmers
mathandcoding.org
7+ C/P, CT $16.99

Circuit Builder 120
myeblox.com
8+ CT, SR $44.99

Snapino
elenco.com
12+ CT, C/P $49.95

Snap Circuits Beginner
elenco.com
5+ M/S, D $24.95

Circuit Scribe Maker Kit
electroninks.com
8+ M/S, CT $79.99

Snap Circuits Arcade
elenco.com
8+ M/S, D $64.95

Electronic Motors Catalyst
tinkeringlabs.com
8+ D, CreaT $55.00

Play 600 PETS
robotis.us
6+ SR, CT $39.95

Play 300 DINOs
robotis.us
8+ SR, CT $34.95

Airblock: The Modular & Programmable Drone
makeblock.com
8+ C/P, CriT $179.95

RoKit Smart
robolink.com
9+ C/P, D $119.78

Snap Circuits 3D Illumination
elenco.com
8+ M/S, D $64.95

Play 700 OLLOBOT
robotis.us
8+ SR, CT $89.95

iQube
tactiles.io
8+ SR, CreaT $199.00

130-in-1 Electronic Playground
elenco.com
10+ M/S, PS $59.95

CODE On The Brink
8+
thinkfun.com
LT, CT $14.99

On the Brink is the first of three games in Thinkfun's CODE programming game series developed together with NASA Programmer Mark Engelberg. The game is recommended for players eight years old to adults and teaches coding in a "screen-free," "unplugged" mode. The kit comes with a challenge booklet that contains 40 game boards varying from beginner to expert. Each game board is a combination of red, blue, orange, and white squares that represent the path for the robot, the user in the game. The box also includes a control panel with three sections of different colors where players can organize their movement cards. On the Brink challenges players to construct three procedures for each color of the control panel so that the robot is able to move from start to finsh. After observing a path on the game board, generating ideas, and planning a solution, players test the solution by moving a robot token along the squares. Players create a prototype "procedure" by placing movement cards on the control panel. Then using evidence-based reasoning, players test and analyze the prototype and decide whether the prototype meets the criteria and doesn't violate the constraints. Constraints are outlined in the manual as movement rules and relate to limitations posed by colored squares and movement cards. Beyond coding skills, On the Brink also helps children develop spatial reasoning and computational, logical and critical thinking skills. The game also teaches children some coding vocabulary, like "procedure," or instruction set. Children will be able to spend many hours moving through the challenges and learning new skills as they go!

Reviewer Feedback

- Child: "This toy takes programming and turns it into a board game. I thought it was challenging but fun."

- Parent: "Challenging fun from the beginning. Instructions well written. I appreciated the "sample" they walked us through to get started. None of us had ever done anything coding related before, and we feel that we learned a lot!"

- Engineer Expert: " This game provides children with a problem - getting the robot to the finish, gives the constraints to work within - executing a specific set of actions on a color, and prompts them to retry their solution until they succeed."

Read full reviews for all gifts included in the guide at **purdue.edu/INSPIRE/EngineeringGiftGuide!**

ACKNOWLEDGMENTS

PURDUE UNIVERSITY®

INSPIRE
Research Institute for Pre-College Engineering

FRONT COVER PHOTO PROVIDED BY Learning Resources®