

Engineering and Design- Creative Building for Inventive Minds

Grades 2-5 (6 book set w/contraption lab)

Children are natural-born engineers and are fascinated with building things and taking things apart to see how they work. Engineering & Design enables children to apply what they know about science and math as they create useful structures. “Technical tales”, “You Do the Math: Design a Skyscraper”, and “Minecraft Lab for Kids” encourage inventive minds through story adventures, non-fiction narratives and comic style texts. Then... Build and demolish a five-story building!

Books in this set: Minecraft Lab for Kids, Design a Skyscraper, How to Build a Car, How to Build a Plane, How to Build a Motorcycle, How to Build a House, Demolition Lab, Weird Contraption Lab

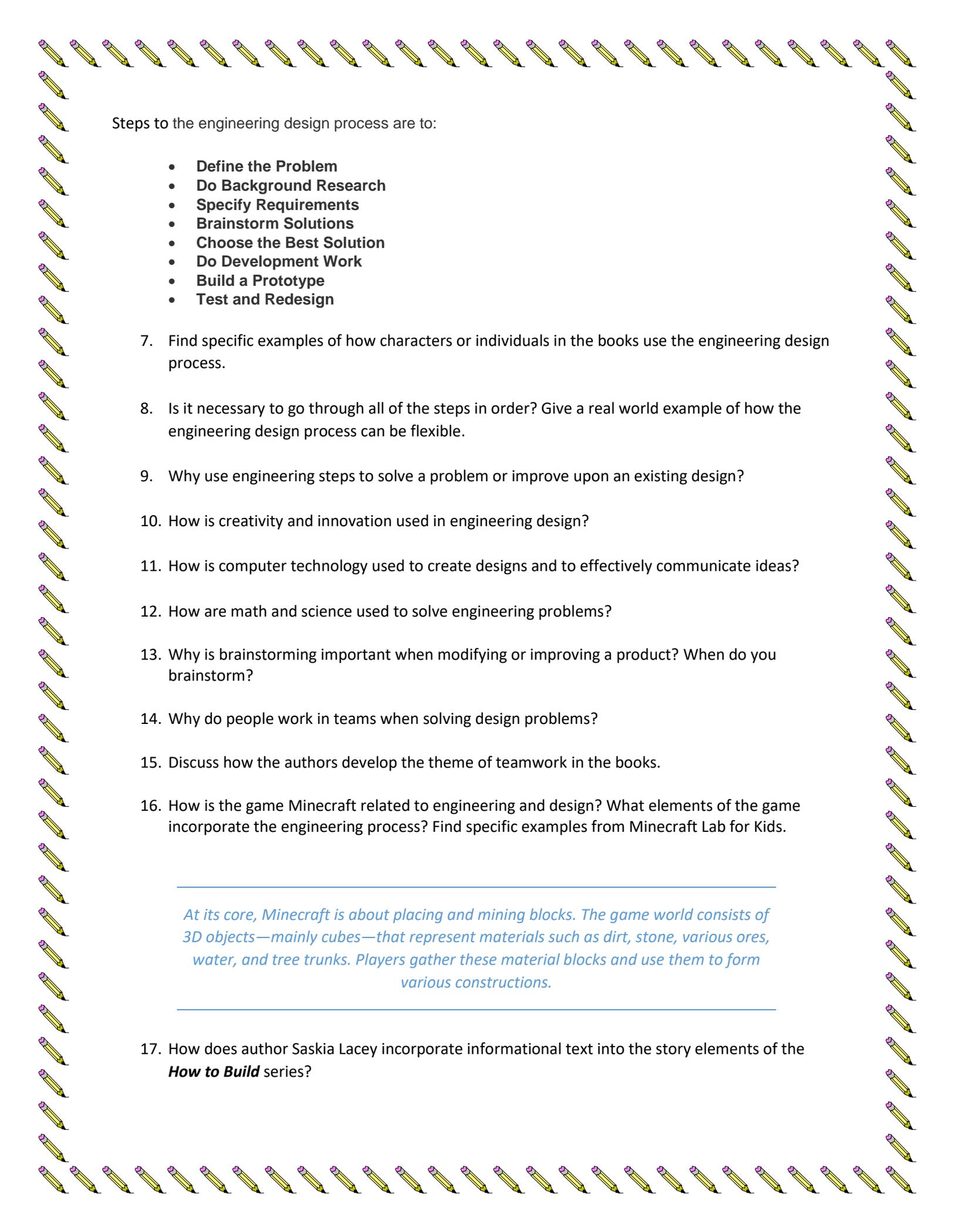
Learning Objectives: Students should understand how to put the design process to use in order to solve a problem they are faced with. Identify and explain the steps of the engineering design process and identify the need or problem, research the problem, develop possible solutions, select the best possible design, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.

Essential Questions in This Unit:

- What is engineering?
- What are the steps to the engineering design process?
- What do engineers do?
- How do engineers solve problems?
- What around you in life involves engineers?
- Why do engineers and designers strive to improve products used in our daily lives?

Engineering is the application of scientific knowledge to solving problems in the real world. Engineering enables this understanding to come to life through problem solving, designing and building things. Read the books in **Engineering and Design- Creative Building for Inventive Minds** to find out:

1. How does engineering work in the real world?
2. What around you in life involves engineers?
3. How do engineers in the books solve problems? Use specific details from the text.
4. Find examples from the books that describe how engineers design, evaluate, develop, test, modify, install, inspect and maintain a wide variety of products and systems.
5. Why do we use the engineering design process to solve design challenges? What design challenges do the characters or individuals in the books need to solve?
6. What are the steps of the design process?



Steps to the engineering design process are to:

- **Define the Problem**
- **Do Background Research**
- **Specify Requirements**
- **Brainstorm Solutions**
- **Choose the Best Solution**
- **Do Development Work**
- **Build a Prototype**
- **Test and Redesign**

7. Find specific examples of how characters or individuals in the books use the engineering design process.
8. Is it necessary to go through all of the steps in order? Give a real world example of how the engineering design process can be flexible.
9. Why use engineering steps to solve a problem or improve upon an existing design?
10. How is creativity and innovation used in engineering design?
11. How is computer technology used to create designs and to effectively communicate ideas?
12. How are math and science used to solve engineering problems?
13. Why is brainstorming important when modifying or improving a product? When do you brainstorm?
14. Why do people work in teams when solving design problems?
15. Discuss how the authors develop the theme of teamwork in the books.
16. How is the game Minecraft related to engineering and design? What elements of the game incorporate the engineering process? Find specific examples from Minecraft Lab for Kids.

At its core, Minecraft is about placing and mining blocks. The game world consists of 3D objects—mainly cubes—that represent materials such as dirt, stone, various ores, water, and tree trunks. Players gather these material blocks and use them to form various constructions.

17. How does author Saskia Lacey incorporate informational text into the story elements of the ***How to Build*** series?

18. Discuss the craft and structure of the books in the series?

19. Compare and contrast the story elements in the books. Including the setting, plot and character development.

Activities

Write an explanatory text on how the engineering design process benefit us in solving problems in our daily lives. Present to the class using visual aids.

Design a model/prototype skyscraper using the engineering design process.

Plan, design and create a board game that requires creativity, collaboration and problem solving.

Research an invention. Create a few pages of a design notebook that would have been used by the inventor.

Complete the challenge using the engineering design process... www.pbs.org/designsquad

The Challenge: Build a handheld “kick stick” that uses a motor-driven, spinning arm to kick a Ping Pong ball across the floor.

Supplies-

3-volt motor (the kind with gear attached to shaft)
AA battery in a battery holder
Cardboard
Rubber faucet washer (¾-inch or larger)
Paper clips

Duct tape
Wire strippers
Aluminum foil
2 craft sticks
Hook-up wire (e.g., 22-gauge, stranded)
Paint stirrer
Ping Pong ball
Scissors

BRAINSTORM

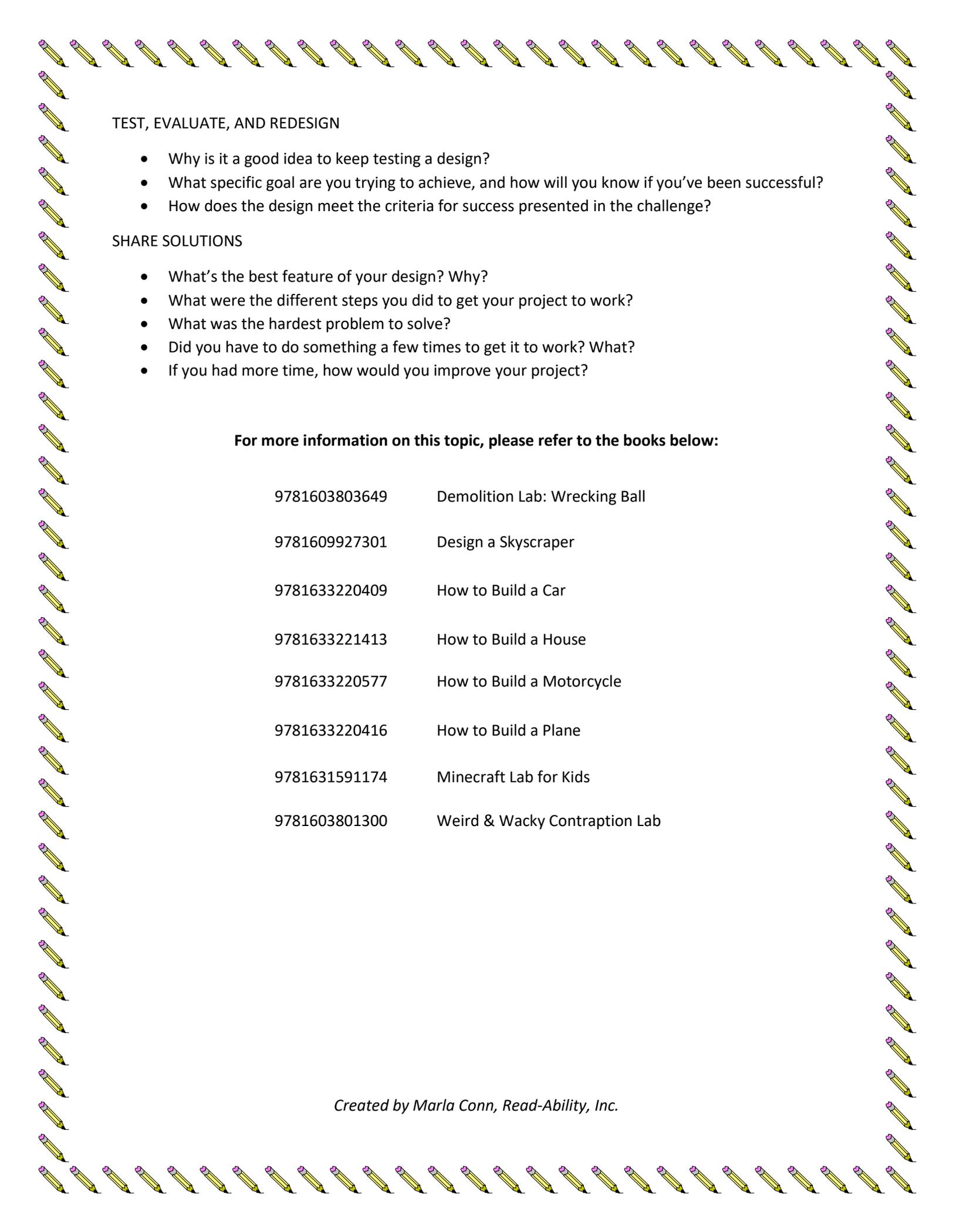
- What are some different ways to tackle today’s challenge?
- Off-the-wall suggestions often spark GREAT ideas. How creative can you be?

DESIGN

- Which brainstormed ideas are really possible, given your time, tools, and materials?
- What are some problems you need to solve as you build your project?
- How can a sketch help clarify your design?

BUILD

- What materials will you need?
- What can you learn by looking at other students’ projects?



TEST, EVALUATE, AND REDESIGN

- Why is it a good idea to keep testing a design?
- What specific goal are you trying to achieve, and how will you know if you've been successful?
- How does the design meet the criteria for success presented in the challenge?

SHARE SOLUTIONS

- What's the best feature of your design? Why?
- What were the different steps you did to get your project to work?
- What was the hardest problem to solve?
- Did you have to do something a few times to get it to work? What?
- If you had more time, how would you improve your project?

For more information on this topic, please refer to the books below:

9781603803649	Demolition Lab: Wrecking Ball
9781609927301	Design a Skyscraper
9781633220409	How to Build a Car
9781633221413	How to Build a House
9781633220577	How to Build a Motorcycle
9781633220416	How to Build a Plane
9781631591174	Minecraft Lab for Kids
9781603801300	Weird & Wacky Contraption Lab

Created by Marla Conn, Read-Ability, Inc.