



## LESSON 7: Testing & Redesigning

### LESSON OVERVIEW

This lesson will guide students to test their prototype and make changes to their original models to modify and improve their design. Students will think about what is working and what could be done better as they test their inventions. They will evaluate their invention with peers through feedback and analyze and apply this feedback to modify their invention design. Finally, students will discover the role of failure in the design process and begin to develop a growth mindset as they see failure as a necessary part of inventing.

### OBJECTIVE

Students will be able to:

- Create and implement a planning process to develop a prototype from a design drawing.
- Test and evaluate their prototype through use and peer feedback to inform decisions on how to modify and improve it.
- Give and receive feedback by evaluating the usefulness and appeal of a prototype.
- Explore design alternatives to develop a second iteration of their prototype.
- See failure as an opportunity to learn, improve, and grow.

### MATERIALS

- Google Slides: YIPLit Lesson 7
- Book: *The Day the Crayons Quit*, by Drew Daywalt, Illustrated by Oliver Jeffers  
ISBN: 0399548920, 978039954892
- Video: *The Day the Crayons Quit*, Read Aloud, (included in Google Slides)  
Link: <https://www.youtube.com/watch?v=gPkrhIEoOJg> (Story Time Out Loud, 7:28 minutes)
- Timer (timer countdown included in Google Slides, or use a clock, phone, or other device)
- Invention Testing Feedback Grid worksheet (included in the YIPLit: Inventor's Journal)  
\*Make extra copies if students have time to swap prototypes with more than one other peer.
- Materials List worksheet (included in the YIPLit: Inventor's Journal)
- Maker Space materials (see Notes for the Teacher for ideas)
- Pencils, pens, markers or crayons for writing and drawing
- YIPLit: Inventor's Journals

### NOTES FOR THE TEACHER

Teacher may use slides provided or lead instruction and discussion on their own.

You may wish to use a “Maker Space” in your school for Lessons 6 and 7, if available. Or you may create a “Maker Space” in your classroom. You may put up posters with quotations about invention, or posters of famous inventors. Make the space comfortable and fun so that students feel inspired to invent. Consider having students build their own Invention Boxes or build a large box for the class. Invention Boxes are

simply boxes or bags filled with materials and supplies to build design models and prototypes. Boxes may include things such as recycled materials (cereal boxes, toilet paper rolls, plastic bottles, yogurt containers, Styrofoam plates, etc.), craft supplies (pipe cleaners, beads, pom poms, popsicle sticks, clothes pins, etc.), yarn and string, construction paper, scissors, tape (duct tape, clear tape, washi tape), rubber bands, glue, markers and more. For more ideas about how to make an Invention Box, you may watch this video, *Dr. Pascha Makes an Invention Box, MIT Lemelson Full Steam Ahead, 2020*. Link: <https://www.youtube.com/watch?v=OZZFDIa1-0U>, (16:35 minutes).

Hot glue guns are recommended for class because they dry quickly and securely so students can maximize their build time in class. If hot glue guns are used, it is recommended that an adult do the gluing.

A 3-D model or prototype of the invention is strongly recommended, but not required for competition at the regional, national and global levels hosted by the Young Inventors' Program and Invention Convention Worldwide. A detailed, labeled drawing of the design is sufficient for the display and presentation. Prototypes and models may be *working or non-working*. Inventors are encouraged to build models that are "materials neutral", meaning they can be made of reused and recycled materials and the overall product should not require money to buy materials. Any materials that are used, whether purchased or found/borrowed, should be listed in the Materials List in the YIP Inventors' Journal.

You may choose to allow students to take their inventions home to work on between sessions. If so, you are encouraged to communicate the requirements and expectations of the project with families, as well as the family's role in this project.

During the Peer Sharing activity, help students keep track of time to be sure each partner gets a chance to give and receive feedback. Consider using a timer and have one student share and receive feedback for 5 minutes and then switch, so the second partner can share and receive feedback. If time allows, try to have students share their inventions with more than one peer for different perspectives. Students may use more than one Invention Testing Feedback Grid if needed (make extra copies).

#### INSTRUCTION & ACTIVITIES

***Teacher may lead the following lesson plan with flexibility to adapt as needed to fit technology and class format:***

##### **Teacher Instruction:**

Take students to a "Maker Space". You may use a maker space in your school, if available, or create one in your classroom (see Notes for the Teacher above). Students will continue to build the model of their invention from Lesson 6. They will want to finish their first version of the prototype and test it so they can make modifications and develop a second iteration of the prototype.

##### **Activity: Build! (15 minutes)**

Allow students to build their invention prototypes. Remind them to spend some time trying it out as they build. They may ask classmates for ideas and help as they build. Create a collaborative and creative space

for everyone to “make”. If students make changes to their design plan or to their step-by-step instructions, ask them to write these changes down on their My Prototype Plan worksheet (included in the YIPLit: Inventor’s Journal) - these are important records in the invention process.

**Teacher Instruction:**

Bring students back together for a discussion. Ask them to think about the following questions.

- How might you go about testing your original design?
- How will you know to try something different and that you need to make modifications to your first design?
- How will you be able to know what modifications you might want to make to your original design?
- Why is testing important to the invention process?

**Activity: Peer Testing and Sharing (10 minutes)**

*Note to teacher: Help students keep track of time to be sure each partner gets a chance to give and receive feedback. Consider using a timer and have one student share and receive feedback for 5 minutes and then switch, so the second partner can share and receive feedback. A timer is included in the Google Slides.*

Ask students to get into pairs. Students will swap inventions and allow a peer to use, test and review the design model. Then, have students complete the Invention Testing Feedback Grid (included in the YIPLit: Inventor’s Journal) with their partner. The partner will share:

1. What they liked about the invention they tested.
2. What **ONE** suggestion do they have to make it better.
3. What questions they have about the invention.

Then, the students will also use this feedback to fill in the box on the lower right: What new ideas were introduced?

Ask students to consider this feedback and think about changes they can make to their original prototype to improve it. If possible, have them write down these modification plans or draw a new design for version 2 of the prototype.

*Note to teacher: If time allows, you may ask students to seek another user’s feedback by having a second round of peer sharing. Use another Invention Testing Feedback Grid worksheet (included in the YIPLit: Inventor’s Journal) if needed.*

**Activity: Redesign! (15 minutes)**

Allow students more time to tinker and make modifications to their prototypes. They should continue to test them as they work to evaluate the success of their changes. Did the changes improve the design? Do more changes still need to be made?

Ask students to help clean up the maker space at the end of the building session. Give instructions on what to do with their finished projects or what they can do if they are not yet finished (Can they take them home to work on them? Will there be more time for them to finish?).

**Closure Activity: Peer Share the Modification (5 minutes)**

Have students show a partner one modification they made to their invention prototype after testing it.

**IDEAS FOR VIRTUAL INSTRUCTION**

**Testing and Sharing**

*Ask students to complete the Invention Feedback Grid (included in the YIPLit: Inventor's Journal) as they ask someone to test and evaluate their first prototype. Have students share or submit their grids for review. You may have an online class sharing session using a virtual platform such as the chat, a shared document, or Zoom breakout rooms to allow students to share their inventions and receive feedback for modifications.*

**Redesign!**

*Have students tinker and make modifications to their prototypes. They should continue to test them as they work to evaluate the success of their changes. Did the changes improve the design? Do more changes still need to be made? You may ask them to submit a reflection or an update on their progress through a virtual platform.*