LESSON 6: Planning & Building

LESSON OVERVIEW
This lesson will support students in making an implementation plan to help them carry out their invention project. They will develop a list of materials they will need and also steps for how they plan to build their design prototype. Finally, they will use a "maker space" (whatever may be available) to build a prototype (working or non-working) using materials provided (recycled carboard, plastic, tape, arts and crafts supplies, glue, etc.).
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 feedback to inform decisions on how to modify and improve it.
MATERIALS
• Google Slides: YIPLit Lesson 6 • 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) • Video (optional for teacher preparation): *Dr. Pascha Makes and Invention Box* Link: https://www.youtube.com/watch?v=OZZFDIa1-0U, (MIT Lemelson Full Steam Ahead, 16:35 minutes). • My Prototype Plan worksheet (included in YIPLit: Inventor's Journal) • 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 of 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 and 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.

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 begin to build the model of their design drawing from Lesson 5- the invention they have created to help their character solve their problem. But, before they get to work, they first must make a detailed plan of the steps they will take to turn their designs into prototypes.

Activity: My Prototype Plan (15 minutes)

Ask students to study their design drawings from Lesson 5's What's the Problem packet (in YIPLit: Inventor's Journal). How are they going to turn their drawing into a 3D model or prototype? Have students complete the My Prototype Plan worksheet (included in YIPLit: Inventor's Journal). Having a step-by-step plan will make building much easier. Ask students if they have ever helped someone with a cooking or baking project. What did they use to tell them what ingredients to use, what order to add them, and how to mix and cook them? They used a recipe! Now, they need to create their own "recipes" for their inventions. Show students the My Prototype Plan worksheet (included in YIPLit: Inventor's Journal) and help them think of how they can write step by step instructions for building their prototypes. Ask them to list, in order, the steps for making their model. If students need help in writing, they can draw the steps in order, or just use key words. Adults may also be needed to help them write. The idea is that they have

some instructions before they build. Students should also list the materials they plan to use to make their prototype. Ask them to think of the possible problems that might occur. How could they solve them if they do occur? Tell them is okay if they alter the plans as they go by adding or eliminating steps, or by using different materials as they build- this is all part of the invention process. But they do need to have something to guide them when they start.

Teacher Instruction:

When students are ready and you have seen and approved their written plans on their My Prototype Plan worksheet, they may begin to build! Tell students that there are all sorts of building materials that they may use and share. Give any instructions on how you wish students to use the materials and share them so that all students have access to what they need.

Activity: Build! (25 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 in their My Prototype Plan worksheet (included in YIPLit: Inventor's Journal)- these are important records in the invention process.

Closure Activity: Clean Up the Maker Space (5 minutes)

Ask students to help clean up the maker space and to put their projects in a safe place until they resume building the next session.

IDEAS FOR VIRTUAL INSTRUCTION

My Prototype Plan

Ask students to complete the My Prototype Plan worksheet (included in YIPLit: Inventor's Journal) on their own. Have students share or submit their plans for review before they start to build their prototype. You may have an online class sharing session using a virtual platform such as the chat, a shared document, or Zoom breakout rooms. Or ask students to submit their plans through a virtual platform.

Build!

Have students begin building their invention prototypes using recycled and other craft materials. Remind them to spend some time trying it out as they build. They may ask family members and others at home for ideas and help as they build. If students make changes to their design plan or to their step-by-step instructions, ask them to write these changes down in their My Prototype Plan worksheet (included in YIPLit: Inventor's Journal)- these are important records in the invention process. You may ask them to submit a reflection or an update on their progress through a virtual platform.