AFTER SCHOOL SESSION 5: TESTING

Base Time: 45-90* minutes *(at least 2 class periods recommended)*

Lesson Overview

This multi-day session (90 minutes is recommended) will guide students through the testing process of developing an invention. Students must test their inventions to make improvements, leading to subsequent iterations of the original design. They will conduct peer testing and then record their activities, data, and observations in their YIP Inventor's Journals or alternative logbooks as they test and refine their inventions, repeating the cycle several times.

Objective

Students will be able to:

- Identify specific claims about their invention.
- Test their invention claim/s with their peers through feedback.
- Analyze and apply their feedback to their invention design.
- Modify their invention based on input they feel is useful or valid.

Materials

Resources for the Educator

- 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).
- Invention Prototype Rubric
- Family Email Template

Materials for the Student

- YIP Inventor's Journals
- Recycled supplies, art/craft supplies (including scissors, tape of all kinds, and glue)
- Worksheet: Peer Testing Feedback Grid (included in Inventor's Journal)
- Worksheet: Changes to Prototype (included in Inventor's Journal)
- Worksheet: Iterations (included in Inventor's Journal)
- Pens/pencils
- Notebook or other paper for writing and drawing

Notes for the Educator

It is recommended that this session take 2 class periods (a minimum of 90 minutes is recommended). The more time you can devote to building and testing, the better. This activity can be completed in one session, but more time is encouraged. Work can be done in class, at home, or in some combination of class and home. Educators are strongly encouraged to allow time for students to connect with their peers to ask questions and share ideas for invention improvement. All parts of this process should be documented in the YIP Inventor's Journal or an alternative Invention Logbook (digital or hard copy). Students are encouraged to make at least 2 iterations of their models before completing the project.

NOTE: Logbooks of some kind are required for submission to the Northern New England Invention Convention and the Invention Convention US Nationals.

If possible, students should have a completed invention prototype at the end of this session. The next lesson will focus on preparing to present their invention to others in an invention fair or showcase. If students need more time, you may ask them to take their projects home or allow more time to finish the final project in the next session before you work on presentations.

NOTE: For students who wish to present their inventions at the Northern New England Invention Convention, please see the After School Optional Session 7 and Session 8, which will guide them in preparing the required elements for competition. To compete, students must have an invention prototype/design, tri-fold display board, video presentation, Inventor's Journal or other logbook, and be able to give a live presentation at the event.

NOTE: You may wish to seek additional volunteers to help younger students with building they require more support with cutting, gluing, and motor skills involved. School staff and parent and community volunteers are good resources if permitted.

NOTE: If assigning work to be done at home, educators are encouraged to communicate the requirements and expectations of the project with families, as well as the family's role in this project. An email template is provided in the Educator Resources- please adapt the letter as needed.

Instruction & Activities

Educator Instruction

After time for invention building and independent testing of the prototype, it is time to collect feedback from others. Remind students of some of the ways that they might test their inventions. You may prompt with questions such as:

- How might you go about testing your original design once you build it?
- 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?

Ask students to write down in their journal how they wish to test their invention or what questions they would want to ask a peer who might test it.

Explain to students the value of constructive feedback. What makes feedback helpful? What information would be useful for the inventor.

Note: YIP recommends using the following feedback models. You may wish to explain these models and what you expect of students as they give feedback.

- *TAG Model: **T**ell something you like about it, **A**sk a question about it, **G**ive a suggestion to improve it*
- *Hamburger Model: **Top bun** is a positive comment about it; **Hamburger** is the feedback that*

will be useful to help improve it; ***Bottom bun*** *is another positive comment about it.*

Activity: Peer Testing (15+ minutes as time allows, more time is recommended)
If working in a team, students should be together as a team during peer sharing so that all group members are involved in the process. Each student should still record the feedback they receive and their ideas for how they might change their design in their own journals so that each student has their own record of the project.

Create a "mix and mingle" activity for the class. Allow students/groups to walk around to share their prototypes and ask peers to test them and provide feedback. Encourage students to provide constructive feedback and positive comments to support the invention process.

Have students complete the Peer Testing Feedback Grid included in the Inventor's Journal to record the feedback received.

For nonworking prototypes:

- Does the prototype accurately represent the solution idea?

For working prototypes:

- Does the prototype work as intended?
- What improvements could be made?
- What about the prototype works well?

Educator Instruction:
Following the peer share, ask the students to consider the feedback they received. What suggestions did people have? How can they use this information to modify and improve their prototype.

If time allows, ask students to complete the Changes to Prototype Worksheet included in the Inventor's Journal. They may write notes about what changes they want to make and why. Then they will draw a new design to show and label it. They should title this design as Prototype Design #2. You may also choose to have students complete this worksheet at home or at the start of the next class session.

Activity: Invention Refining (20+ minutes as time allows, more time is recommended)
Allow students as much time as possible to refine and tinker with their prototypes to incorporate the modifications they developed based on feedback. Remind students to continue to test as they complete their refined designs (a second or third iteration) to continue to tweak and modify the invention until they are satisfied with the outcome. They may complete the Iterations Worksheet included in the Inventors' Journal.

DAY 2: ***(optional but recommended)***
Educator Instruction
Resume the work from the previous class session. Allow more time for refining the prototypes and more peer testing.

If you wish, you can create another “Mix and Mingle” peer sharing session for the class, or just allow students/groups to collaborate on their own. The, follow with time to continue to refine the prototypes based on new feedback and testing data.

NOTE: Students may continue this cycle several times as time allows. It is recommended that students have at least 2 iterations of their prototype to show the evolution of the invention. You may wish to make more copies of the Peer Testing Feedback Grid that students can use during peer sharing and insert them into their journal.

Students should try to have a final invention prototype at the end of this session. The next session will focus on preparing a presentation of the invention for an invention fair or showcase. If students are not finished with their prototypes, they may take them home to finish or you may allow for additional time in the next session before moving on to the presentation preparation.

Ideas for Virtual Instruction

Activity: Peer or Other Person Testing

Ask students to ask others at home to test their prototypes and provide feedback. Complete the Peer Feedback Testing Grid included in the Inventor’s Journal. Students may submit photos or updates on their progress using a platform of choice. Then, have them complete the Changes to Prototype Worksheet included in the Inventor’s Journal. They may write notes about what changes they want to make and why. Then they will draw a new design to show and label it. They should title this design as #2.

Activity: Invention Refining

Ask students to begin to revise their invention prototype using the suggestions and feedback received. Students may submit photos or updates on their progress using a platform of choice.

Take Home Assignment

(optional if giving take home work)

Ask students to complete the Changes to Prototype Worksheet. They may write notes about what changes they want to make and why. Then they will draw a new design to show and label it. They should title this design as Prototype Design #2.