

LESSON 6: REFINING & ITERATING

Invention Process Steps: Redesigning

Grade Level: 3-5

Base Time: 45-75* minutes (*more time is recommended*)



ESSENTIAL QUESTION

How can I improve my prototype and how do I know if my redesign is successful?

LESSON OVERVIEW

This lesson will guide students to review the peer feedback they have received and make more improvements to their prototype. This is a cycle that should repeat at least 2-3 times during the course of the invention project. Students will continue to modify and evaluate their prototypes with multiple peer shares to gather information and different perspectives on the function and quality of their prototypes. They will record all of their activities, data, and observations in their YIP Inventor's Journals or alternative logbooks.

OBJECTIVE

Students will be able to:

- Review their ideas using directed feedback from testing.
- Analyze and apply their feedback to their invention design.
- Modify their invention based on input they feel is useful or valid.

LESSON STANDARDS

Next Generation Science Standards:

- 3-5-ETS1-3

Common Core ELA Standards:

- CCSS.ELA-LITERACY.W 3.2, 4.2, 5.2
- CCSS.ELA-LITERACY.W 3.5, 4.5, 5.5
- CCSS.ELA-LITERACY.SL 3.1, 4.1, 5.1
- CCSS.ELA-LITERACY.SL 3.3, 4.3, 5.3

MATERIALS

Resources for the Educator

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)

NOTES FOR THE EDUCATOR

It is recommended that this lesson take 2 class periods (75+ minutes is recommended).

This lesson continues the cycle of building-testing-re-designing the prototype which will require educator guidance and as much independent work time as possible. You should assign a specific number of hours

(we recommend 4-6 hours) to be devoted to design and building. If doing work at home, you may ask students to check in on their progress. Educators are strongly encouraged to allow time for students to connect with them and 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). Logbooks of some kind are required for submission to the Northern New England Invention Convention and the Invention Convention US Nationals.

Students may feel frustrated during the build-test- refine process. Encourage them and remind them that it's ok if things do not work perfectly, or at all, at first. It may take many tries before they reach their goals. This is part of the invention process.

INSTRUCTION & ACTIVITIES

Educator Instruction:

At this point, students should have a second design of their prototype based on feedback received after at least one round of peer/user testing.

Explain to students that they now have some data from their peer/using sharing recorded on their Peer Testing Feedback Grid. Ask them to consider what worked well and what didn't work well. They can compare the results from different tests (if they tested with more than one user) and identify common themes. They should record these themes in their journal. Now, ask students to look back at their original problem statement and solution idea (on their Intent to Invent Worksheet). Does the current version of the prototype align? What changes can be made to improve the prototype? Why? How can they make these changes?

Activity: Redesign Drawing (10+ minutes as time allows, more time is recommended)

If working in a team, students should be together as a team during the redesign phase so that all group members are involved in the process. Each student should still record their activities in their own journals so that each student has their own record of the project.

At this point, students should have completed the Changes to Prototype Worksheet included in the Inventor's Journal. They may write notes about what changes they want to make and why. Remind students that good inventions are trying to solve a problem or need. Students should draw the new design and label each part of their drawing. They should title this design as Prototype Design #2.

Once students have a Prototype Design #2 drawing, have them swap their redesigns with a partner. Partners should give more feedback including the following:

- What is one part or aspect of the drawing that is original and/or well thought out?
- What is one thing the inventor can do to improve the invention?

Students should record this feedback on the Changes to Prototype Worksheet in the space provided.

NOTE: Students in grades 3-5 should have at least 2 design drawings (iterations) recorded for their project. More iterations are recommended as they show the evolution of the invention and the process if they intend to compete in regional/state or national Invention Conventions. An Iterations Worksheet with space for a

third design drawing is included in the Inventor's Journal. It is not required that students use this page, but it is encouraged.

Activity: Invention Refining (30+ 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.

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.

IDEAS FOR VIRTUAL INSTRUCTION

Activity: Refine Drawing

If not completed in Lesson 5 or at home, 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. Remind students that good inventions are trying to solve a problem or need. Students should draw the new design and label each part of their drawing. They should title this design as Prototype Design #2. Students may submit their work using the platform of choice.

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.

CHECK FOR UNDERSTANDING

Educator may wish to do one of the following to check for understanding:

In a whip-share or group share, ask students to share one word about how they are feeling about going through the refine process. (It is important that students try to use only one word to reflect.)

TAKE HOME ASSIGNMENT
(OPTIONAL IF GIVING TAKE HOME WORK)

Ask students to draw another iteration incorporating any valid ideas from the peer share and title this design Prototype Design #3.

Continue to re- build and modify prototype.