Lesson 5.2
Testing and Improving Our Box Models
Lesson Overview

Students continue to learn about the design cycle, specifically how engineers use testing to make their solutions even better. They apply this idea as they make final changes to their Box Models. The lesson begins with a Read-Aloud of the second half of the Room 4 Solves a Problem book, which illustrates how students solve a problem by testing and making, iteratively, as part of the design cycle. Students use what they learn in the story to finish the What Engineers Do chart by adding the “Test” phase, noting how engineers engage in various phases of the design cycle over and over. Students continue to work on their Box Models, testing their solutions to see if the model works as expected and making changes as necessary. The lesson closes with students beginning to write a mini-book about how their Box Model works. The purpose of this lesson is to continue toward completing the Box Models and to provide students with a deeper experience of working with all phases of the design cycle.

Anchor Phenomenon: Pinball machines allow people to control the direction and strength of forces on a ball.
Design Problem: Design a pinball machine.

Students learn:

- Engineers test their solutions to problems and make changes based on what happens.
Completing Read-Aloud: Room 4 Solves a Problem

Students participate in a Read-Aloud of Room 4 Solves a Problem to see how the class continues to design solutions to their problem.

Instructional Guide

1. **Show the cover of Room 4 Solves a Problem.** Remind students they read the first half of the book in the last lesson.

2. **Refer to the What Engineers Do chart to discuss the problem.** Point to the chart as you remind students that, in the book, the students in Room 4 worked as engineers to solve a problem about their class pet.

   - **What problem were the student engineers trying to solve?**
     - [Their rat needed more exercise.]

3. **Point to Learn.** Turn to the images on pages 6–7.

   - **What did the students learn from their teacher about exercises for rats?**
     - [Rats cannot do exercises like jumping jacks or lifting weights.]

4. **Point to Plan.** Turn to the images on pages 8–10.

   - **How did the students plan a solution to their problem? What did they do?**
     - [Went home to think of ideas. Drew pictures and diagrams. Shared their ideas.]

5. **Point to Make.**

   - **Yesterday, you predicted that the students in Room 4 would make their solutions next. Today, we will read about what types of solutions they made and how they worked.**

6. **Set the purpose for reading.**
As we read the second part of the book today, keep thinking about how the children in the book are engineers. Listen for times when the students in Room 4 make their solutions do all the things they want them to do.


I can visualize how Ratty is pushing a big ball that does not fit. It keeps falling off when Ratty pushes it.

8. Pause briefly after page 13 to visualize. Remind students to make a picture in their head about what Omar just did.

What did Omar have to do to make his idea work?
[Use a smaller ball. Change his plan]

That is right—Omar had to make changes to make his solution work.

Let’s read and find out if Kai needs to make changes to her solution after testing it.

9. Continue reading through page 17. Remind students to visualize Kai’s idea as you read.

Did Kai’s first solution work?
[No.]

So, what did Kai do after she tested her first solution?
[She made changes. She got new ideas. She used different peas.]

After she tested her second solution, did it work?
[Yes.]

How is that like what happened to Omar?
[It did not work the first time. They tried it out two times.]

I see a pattern! Students tested and made changes. Then, their solutions worked much better to give Ratty the exercise he needs.

10. Continue to read through the end of the book.
Completing Read-Aloud: Room 4 Solves a Problem

Students participate in a Read-Aloud of Room 4 Solves a Problem to see how the class continues to design solutions to their problem.

Instructional Guide

1. Show the cover of Room 4 Solves a Problem. Remind students they read the first half of the book in the last lesson.

2. Refer to the What Engineers Do chart to discuss the problem. Point to the chart as you remind students that, in the book, the students in Room 4 worked as engineers to solve a problem about their class pet.

¿Qué problema estaban intentando resolver los ingenieros estudiantes?
[Su rata necesitaba más ejercicio].

3. Point to Learn. Turn to the images on pages 6–7.

¿Qué aprendieron los estudiantes de su maestro sobre ejercicios para ratas?
[Las ratas no pueden hacer ejercicios como saltos de tijera o levantar pesas].

4. Point to Plan. Turn to the images on pages 8–10.

¿Cómo planearon los estudiantes una solución para su problema? ¿Qué hicieron?
[Regresaron a sus hogares para pensar en ideas. Hicieron dibujos y diagramas. Compartieron sus ideas].

5. Point to Make.

Ayer predijeron que los estudiantes en el Salón 4 crearían sus soluciones a continuación. Hoy leeremos sobre qué tipos de soluciones crearon y cómo funcionaron.

6. Set the purpose for reading.
Mientras leemos la segunda parte del libro hoy, sigan pensando en cómo los niños en el libro son ingenieros. Estén atentos a escuchar cuando los estudiantes en el Salón 4 logran que sus soluciones hagan todas las cosas que ellos quieren que hagan.

7. **Read pages 11–12 aloud.** Pause on page 12 to model visualizing.

Puedo visualizar cómo Ratty está empujando una pelota grande que no cabe. No deja de caerse cuando Ratty la empuja.

8. **Pause briefly after page 13 to visualize.** Remind students to make a picture in their head about what Omar just did.

¿Qué hizo Omar para lograr que su idea funcionara? [Usar una pelota más pequeña. Cambiar su plan].

Es correcto: Omar tuvo que hacer cambios para lograr que su solución funcionara.

Leamos y averigüemos si Kai necesita hacer cambios a su solución después de testearla.

9. **Continue reading through page 17.** Remind students to visualize Kai’s idea as you read.

¿La primera solución de Kai funcionó? [No].

Entonces, ¿qué hizo Kai después de que testeó su primera solución? [Ella hizo cambios. Obtuvo nuevas ideas. Usó diferentes vegetales].

Después de que testeó su segunda solución, ¿funcionó? [Sí].

¿En qué se parece eso a lo que le sucedió a Omar? [No funcionó la primera vez. La probaron dos veces].

¡Yó veo un patrón! Los estudiantes testearon e hicieron cambios. Luego, sus soluciones funcionaron mucho mejor para dar a Ratty el ejercicio que necesita.

10. **Continue to read through the end of the book.**