Lesson 5.1
Room 4 Solves a Problem
Lesson Overview

Students learn more about the design cycle and make changes to their Box Models that they predict will help them meet all their pinball machine design goals. The lesson begins with a Read-Aloud of Room 4 Solves a Problem, a book about a kindergarten class that uses the design cycle in order to solve a problem with their class pet. Students listen to the first half of the book and then reflect on how the class in the story used the design cycle—particularly, how they planned solutions by drawing diagrams. Working within the design cycle themselves, students draw diagrams in their Investigation Notebooks to plan design changes to their Box Models. Students then follow their plans by adding parts to the Box Models. The purpose of this lesson is to provide a model of the design cycle in use, allowing students to deepen their understanding of how engineers design as they begin designing the final version of their Box Model pinball machines.

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:

- Sometimes engineers draw diagrams to plan how they will make a solution.
The teacher introduces new questions related to students’ role as engineers, and then reads aloud the first half of *Room 4 Solves a Problem*.

**Instructional Guide**

1. **Revisit students’ role as pinball engineers.** Begin the chapter by asking students to recall their engineering work and the problem they have been designing a solution for. [Making a pinball machine for the class.]

2. **Refer to the Pinball Machine Design Goals chart.** Remind students that they have watched the *Pinball* video several times in order to figure out what a pinball machine can do.

   - We had a big problem: how to design a pinball machine. Engineers, like us, who work on big problems often solve them one piece at a time. We had to figure out how to design our pinball machine to make the pinball move one new way at a time.

   - We added new design goals to our Pinball Machine Design Goals chart each time we watched the video. We learned about the forces that made the pinball machine work, made our designs in our Box Models, and checked off our design goals one at a time.

   - What are some of the goals that we have checked off? [Make the pinball move to the left/right, move short/long distances, hit a target, and change direction.]

3. **Introduce the Chapter 5 Question.**

   - You already figured out how to make the pinball machine do each thing on our Pinball Machine Design Goals checklist. Now we want to design our Class Pinball Machine to make the pinball move in all of these different ways whenever we play.

Point to the new Chapter 5 Question and read it aloud.
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Activity 1
Pushes and Pulls
Lesson Guides

How can we make the pinball machine do all the things we want it to do?

4. Introduce the new Investigation Question. Remind students that they have solved small pieces of their problem (such as adding bumpers, flippers, a target, a shoelace, and a launcher), but they have not yet put all their learning together.

- We are ready to design a solution to our problem. Before we do, I think it will be helpful for us to figure out how other engineers design solutions to their problems. We need to ask ourselves: How do engineers make their solutions do all the things they want them to do?

5. Introduce the book. Display the cover of the Room 4 Solves a Problem big book. Explain that you will now read aloud a story about a group of student engineers who try to design a solution to a problem in their classroom.

- These students are designing solutions, just like we are.


- We will read this story to find out what the students in Room 4 did to help them make their solutions. When we read this book next time, we will read about how they improved their solutions, or made them even better.

7. Read the title and make predictions.

- What do you notice about this class? What problem do you think they might be trying to design a solution for?

8. Read aloud Room 4 Solves a Problem and pause after page 5 to model visualizing.

- We just heard what the problem is: Ratty needs more exercise. I can make a picture in my mind of what Mr. S is saying, of how the students can play with Ratty more, and of how he also needs to have ways to exercise. I imagine some of the students will design a solution to help.

9. Continue to read aloud, pausing after page 7. Ask students to talk with a partner what kinds of solutions they can visualize for Ratty to do exercises by himself in his cage.

10. Continue to read aloud through page 10. Be sure to read the labels on the student diagram illustrations.

11. Highlight diagrams. Flip back through the student diagrams on pages 8–10. Discuss each diagram and ask students about what each diagram shows.

- We were recording what we made when we drew diagrams of our Box Models. Recording with diagrams helps engineers keep track of their ideas.

- Engineers draw diagrams for other reasons, too. Sometimes engineers make diagrams to help them think about what their solution will be. They use diagrams to plan their solutions.
12. Highlight erasures in illustrations. Point out that there are eraser marks on each diagram on pages 8–10. Focus on the page 10 diagram.

Why do you think the students erased something on this diagram? [They thought the flap would work better in a different place. They decided it would work better a different way.]

When Leo and Jayden talked about their diagrams, they were planning what they were going to make. Maybe they erased one flap because they decided they would make the flap over here. Sometimes engineers think of new ideas as they draw diagrams and decide to change things.

13. Conclude the Read-Aloud.

These students visualized and drew solutions they thought might work.

We will stop here for today and continue reading in the next lesson to find out how Room 4 made a solution to their problem.

Teacher Support

Background

About the Book: Room 4 Solves a Problem
In Room 4 Solves a Problem, a group of kindergartners encounter a problem: Their class pet, Ratty, needs to get more exercise. Students jump into action, designing solutions that use pushes and pulls to alleviate Ratty’s problem. They test out several solutions and then refine and improve their solutions until they have designed the perfect push-and-pull exercises for Ratty. Room 4 Solves a Problem is a Read-Aloud book that models the design process that students are using to create their pinball machines in the unit.

Rationale

Engineering Note: The Design Cycle
As you refer to the design cycle with students, try to avoid referring to the parts of the cycle as steps. We have intentionally avoided the use of this term, as it implies a sequential order. The design cycle is an iterative process that can go back and forth between different parts, or phases, as needed. The phases do not need to be followed in a fixed order.
Read-Aloud: Room 4 Solves a Problem

The teacher introduces new questions related to students’ role as engineers, and then reads aloud the first half of Room 4 Solves a Problem.

Instructional Guide

1. **Revisit students’ role as pinball engineers.** Begin the chapter by asking students to recall their engineering work and the problem they have been designing a solution for. [Making a pinball machine for the class.]

2. **Refer to the Pinball Machine Design Goals chart.** Remind students that they have watched the Pinball video several times in order to figure out what a pinball machine can do.

   Tuvimos un gran problema: cómo diseñar una máquina de pinball. Los ingenieros, al igual que nosotros, que trabajan en problemas grandes a menudo los resuelven por parte. Tuvimos que averiguar cómo diseñar nuestra máquina de pinball para hacer que la pelota de pinball se mueva de una manera nueva a la vez.

   Agregamos nuevas metas de diseño a nuestra Gráfica de metas del diseño para la máquina de pinball cada vez que vimos el video. Aprendimos acerca de las fuerzas que hacían que funcionara la máquina de pinball, hicimos nuestros diseños en nuestros modelos y tachamos nuestras metas de diseño una a la vez.

   ¿Cuáles son algunas de las metas que hemos tachado? [Hacer que la pelota se mueva hacia la izquierda/derecha, se mueva distancias cortas/largas, dar en un blanco y cambiar de dirección].

3. **Introduce the Chapter 5 Question.**

   Ya han averiguado cómo hacer que la máquina de pinball haga cada cosa en nuestra lista de verificación de Metas del diseño para la máquina de pinball. Ahora queremos diseñar nuestra máquina de pinball de la clase para hacer que la pelota de pinball se mueva de todas estas maneras diferentes cada vez que juguemos.

Point to the new Chapter 5 Question and read it aloud.
¿Cómo podemos hacer que la máquina de pinball haga todas las cosas que queremos que haga?

4. Introduce the new Investigation Question. Remind students that they have solved small pieces of their problem (such as adding bumpers, flippers, a target, a shoelace, and a launcher), but they have not yet put all their learning together.

Estamos listos para diseñar una solución para nuestro problema. Antes de eso, pienso que será útil para nosotros averiguar cómo otros ingenieros diseñan soluciones a sus problemas. Necesitamos preguntarnos: ¿Cómo hacen los ingenieros que sus soluciones hagan todas las cosas que ellos quieren que hagan?

5. Introduce the book. Display the cover of the Room 4 Solves a Problem big book. Explain that you will now read aloud a story about a group of student engineers who try to design a solution to a problem in their classroom.

Estos estudiantes están diseñando soluciones, igual que nosotros.


Leeremos esta historia para descubrir lo que los estudiantes en el Salón 4 hicieron para ayudarlos a crear sus soluciones. Cuando leamos este libro la próxima vez, leeremos sobre cómo mejoraron sus soluciones.

7. Read the title and make predictions.

¿Qué notan sobre esta clase? ¿Para qué problema piensan que podrían estar intentando diseñar una solución?

8. Read aloud Room 4 Solves a Problem and pause after page 5 to model visualizing.

Acabamos de oír el problema: Ratty necesita más ejercicio. Puedo hacer una imagen en mi mente de lo que está diciendo el Sr. S, de cómo los estudiantes pueden jugar más con Ratty y de cómo él también necesita tener maneras de ejercitarse. Imagino que algunos de los estudiantes diseñarán una solución para ayudar.

9. Continue to read aloud, pausing after page 7. Ask students to talk with a partner what kinds of solutions they can visualize for Ratty to do exercises by himself in his cage.

10. Continue to read aloud through page 10. Be sure to read the labels on the student diagram illustrations.

11. Highlight diagrams. Flip back through the student diagrams on pages 8–10. Discuss each diagram and ask students about what each diagram shows.

Estuvimos apuntando lo que creíamos cuando dibujamos diagramas de nuestros modelos. Apuntar con diagramas ayuda a los ingenieros a llevar un registro de sus ideas.

Los ingenieros dibujan diagramas por otras razones también. A veces los ingenieros hacen diagramas para ayudarlos a pensar en cuál será su solución. Usan diagramas para planear sus soluciones.
12. Highlight erasures in illustrations. Point out that there are eraser marks on each diagram on pages 8–10. Focus on the page 10 diagram.

¿Por qué piensan que los estudiantes borraron algo en este diagrama? [Pensaron que la solapa funcionaría mejor en un lugar diferente. Decidieron que funcionaría mejor de una manera diferente].

Cuando Leo y Jayden hablaban sobre sus diagramas, estaban planeando qué iban a crear. Tal vez borraron una solapa porque decidieron que harían la solapa por aquí. A veces los ingenieros piensan en ideas nuevas mientras dibujan diagramas y deciden cambiar cosas.

13. Conclude the Read-Aloud.

Estos estudiantes visualizaron y dibujaron soluciones que pensaban que podrían funcionar.

Nos detendremos aquí por hoy y continuaremos leyendo en la siguiente lección para averiguar cómo el Salón 4 creó una solución para su problema.

Teacher Support

Background

About the Book: Room 4 Solves a Problem
In Room 4 Solves a Problem, a group of kindergartners encounter a problem: Their class pet, Ratty, needs to get more exercise. Students jump into action, designing solutions that use pushes and pulls to alleviate Ratty’s problem. They test out several solutions and then refine and improve their solutions until they have designed the perfect push-and-pull exercises for Ratty. Room 4 Solves a Problem is a Read-Aloud book that models the design process that students are using to create their pinball machines in the unit.

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