

DiscoverE Challenge: Step Launcher

Student Instructions:

Challenge

Design a way to launch a small ball off the floor so you can catch it!

These instructions are also presented in a short video by Bentley Systems engineer Murray Fredlund. Watch on YouTube here: https://youtu.be/xmP_ArRo6v0

Introduction

This Step Launcher challenge is a great way to explore **levers**, simple machines that turn a small motion into a big one. Levers do this by pivoting a long object on a balancing object called the **fulcrum**.

Engineers use different kinds of levers to accomplish a wide range of tasks, from a simple ramp for lifting heavy objects to complex robots that use levers to help them move!

Collect Your Materials

- A ping pong ball, or small foam ball, to launch
- Lever materials like paint stirrers, rulers or spoons
- Fulcrum materials like thread spools or paper towel tubes
- Tape or rubber bands
- Feel free to use other building materials you might find at home – be creative!

1. Identify the Problem

- The most critical step of any engineering challenge is to **understand the problem** you are trying to solve.
- How can you design a way to launch a small ball off the floor so you can catch it? Here are the **specs**:
 - You may only use one foot to make your launcher work.
 - Your design must launch the ball upward and high enough for you to catch it.

2. Brainstorm Designs

- Experiment with your materials and maybe sketch some ideas before you start building.
- Consider how your materials might affect the ball's **trajectory**, or path through the air:
 - Why are ping pong / foam balls challenging to launch straight up in the air?
 - How does the length of the lever affect the trajectory of the ball? What about the placement of the fulcrum?

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3. Build and Test Your Design

- Choose one design idea and start building!
 - How can you use connective materials like tape or rubber bands to hold your design together?
- Test your design. Did it work like you thought it would? Are there things you want to adjust or change to make it better?

4. Make Changes and Try Again

- Redesign your launcher and test again.
- If your first design was successful, you can up the ante with a new challenge...like shooting the ball up twice as high or launching it into a wastebasket – the possibilities are endless!

5. Share Your Results with a teacher, parent/guardian, or DiscoverE

- Share photos or a video of your launcher in action!
- Send to DiscoverE at social@DiscoverE.org or post on Instagram/Twitter using the hashtag **#DiscoverEChallenge**