THE SCIENCE OF SOCCER

ENGINEERED BY THE FRANKLIN INSTITUTE

Activity 1

USE THE FORCE!

Activity 1: **Use the Force!**

Audience: Children ages 6-10

Time Frame: 30-45 minutes

Summary: In this activity, learners will become "soccer scientists," experimenting with how different amounts and directions of force affect the motion of a ball. Using simple tools to simulate kicking, they will investigate speed, distance, control, and precision—just like real soccer players do on the field.

Guiding Questions:

- How does the way you kick or push a ball change how it moves?
- How can experimenting like scientists help soccer players improve their game?

Science Concepts:

Force: A push or pull that can make something start moving, stop moving, or change directions.

Motion: The way something moves from one place to another.

Trajectory: The path something takes when it moves, like the way a ball travels after you kick or throw it.

For more information about these concepts, see the Background section at the end of this guide.

MATERIALS

- Large plastic tray (1 per group of 3-4 learners)
- Mini soccer net (1 per group)
- Mini soccer feet (2 sets per group)
- Mini soccer ball (1 per group)
- Masking tape
- Plastic figurines or wooden block "players" (4-6 per group)
- *Use the Force!* photo printouts
- *Use the Force!* challenge cards (1 set per group)
- Optional: Internet access, computer, and screen for playing video clips

SET-UP

1. Print photos and challenge cards, if needed.
2. Set up soccer field models (1 per group of 3-4 learners):
   - Secure a mini goal at one short end of the tray using tape so it remains stable during play.
   - Check that all trays are placed on level surfaces to ensure consistent ball movement.
3. Where possible, set up video equipment and cue up one or more of the video clips listed in the Video Resources section at the end of this guide.

ENGAGE (10 MIN)

1. Gather the group and show the photos or video clips (*if possible*) of soccer players in action. Ask:
   - What sport do you think this is?
   - What comes to mind when you think about soccer?
   - Who has played or watched soccer before?
2. Ask learners to observe the ball in the images or videos:
   - What do you notice about how the ball moves in different pictures or video clips?
   - How do the players use their feet to control the ball?
   - What do they do to change its direction or speed?
   - What are different ways you've kicked or thrown a ball?
3. Explain that when soccer players pass, shoot, or dribble, they're not just playing—they're using science! Every move involves **force** and **motion** to make the ball behave in different ways.
   - Describe that a force is a push or pull and force makes things move or stop.
4. Ask learners: What can we change about the way we push or pull a ball?
   - When a soccer player makes the ball move where they want it to go, they are controlling the strength and direction of the pushes and pulls they give.
5. Introduce the idea that today learners will be using a **model of a soccer game**, a smaller version that represents the real thing, to experiment with the ball and discover different ways to change the **trajectory** of the ball.
   - Describe that the trajectory is the path the ball takes when it moves based on the force that is applied.

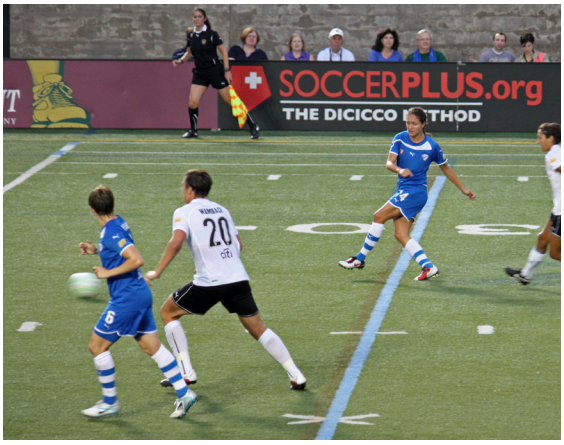
You may want to mention that in 2026, the US, Mexico, and Canada are hosting the Men's World Cup, where men's soccer teams from countries across the world come to compete for the title of World Cup Champion. The next Women's World Cup will take place in Brazil in 2027.

EXPLORE (20-30 MIN)

1. Divide the group into teams of 3-4 and distribute the challenge materials and cards.
2. Briefly introduce the first challenge scenario, science goals, and instructions (see below).
3. As teams are exploring the challenge, ask guiding questions such as:
   - What did you see change when you kicked harder or softer?
   - Did you notice any differences when you tried going fast vs. slow?
   - If you tried again, what would you do differently to be more accurate?
   - How do you think soccer players practice these same skills on the field?
4. After about five minutes, or as groups seem ready, suggest that they try the next challenge. Older learners may be able to read the challenge card independently. For younger learners, describe the challenge and help them set up the model field as needed.
5. Encourage groups to try Challenges 3 and 4 as time and interest permit.

CHALLENGE 1: LONG SHOT

- **The scene:** Your teammate is open across the field close to the goal. Can you quickly get the ball right to them so they can score?
- **The science:** Explore how different amounts of force affect the ball's speed and distance.
- **What to do:**
  - Put yourselves around the model field, some close to the goal and some farther away.
  - Use the soccer feet or your fingers to "kick" the ball.
  - Choose a teammate to kick the ball to, so they can score.
  - Try three levels of force: soft, medium, and strong kicks.
  - Try aiming for a different teammate.
  - Switch places so each person gets to try different positions.
- **Questions to think about:**
  - How much force do you need to kick the ball to a close player? To a faraway player?
  - Which kicks are easier to aim correctly, soft or strong?



CHALLENGE 2: AVOID THE WALL

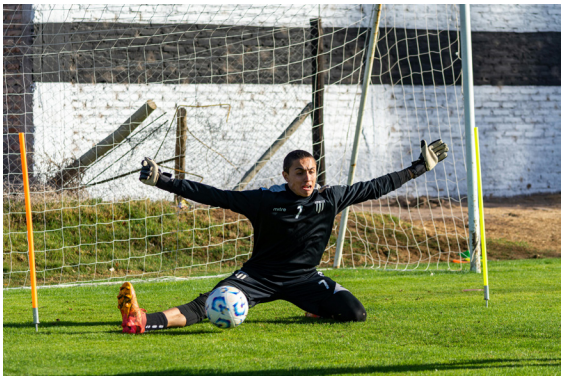
- **The scene:** You have a free kick near the goal, but you need to get the ball around a wall of defenders in front of it.
- **The science:** Explore how direction and angle of force change the ball's motion.
- **What to do:**
  - Put 3 or 4 figures or blocks in front of the goal as defenders.
  - Use the soccer feet or your fingers to "kick" the ball.
  - Try to kick it around the defenders without touching them.
  - Try kicking from different angles.
- **Questions to think about:**
  - How does changing your kick angle change the path of the ball?
  - What angles or kicks work best for getting around defenders?

CHALLENGE 3: ZIG ZAG

- **The scene:** There are defenders all over the field! You need to keep the ball away from them while heading for the goal.
- **The science:** Practice controlling forces to change the ball's path (trajectory).
- **What to do:**
  - Set up figures or blocks around the model field as defenders.
  - Use the soccer feet or your fingers to "kick" the ball.
  - Try to get the ball into the goal without touching any defenders.
- **Questions to think about:**
  - What kinds of forces work best to keep the ball where you want it?
  - What happens when you try to move faster or slower?

CHALLENGE 4: QUICK STOP

- **The scene:** The ball is rolling toward the goal. Can you stop it exactly where you want?
- **The science:** Explore how to slow or stop motion with force applied in the opposite direction.
- **What to do:**
  - Assign one person to be the goalkeeper. They try to stop the ball before it reaches the goal.
  - Other players take turns "kicking" the ball toward the goal.
  - Try using different amounts of force to stop the ball.
  - Change the angle of your kicks and blocks to see how the ball's path (trajectory) changes.
  - Switch roles so everyone gets a turn being the goalkeeper and the kicker.
- **Questions to think about:**
  - What happens when you stop the ball with a soft touch? What about a hard push?
  - How does the ball move differently when you block it from the side instead of straight on?



REFLECT (5 MIN):

- Gather the group to discuss what they noticed about how the ball moved in the different challenges. Ask:
  - What was one way you made the ball move differently today?
  - Which challenge was the hardest? Why?
- Encourage the group to think about how they were like scientists. Ask:
  - How did you feel like a scientist today?
  - How did experimenting help you learn something new about soccer?
  - If you were going to coach someone else, what advice would you give them about how to control the ball?

BACKGROUND

Soccer is a sport full of science—especially when it comes to **force** and **motion**. Every time a player kicks, passes, or traps the ball, they're applying a force that changes the ball's direction, speed, or distance. Understanding how different kinds of kicks affect the ball's **trajectory**, or movement, helps players control the game—and gives students a hands-on way to explore physics concepts like strength, direction, and friction.

VIDEO RESOURCES:

Men's Soccer Highlights:

https://www.youtube.com/watch?v=aTTOQtSOX3I

Women's Soccer Highlights:

https://www.youtube.com/watch?v=m5IXs5ASt3c