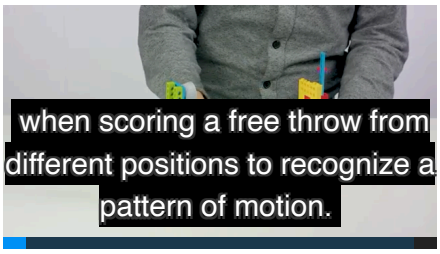
Free Throw

Explore the motion of a basketball when scoring a three-point throw. Can you score a perfect basket every time?



30-45 min. | Intermed. | Grades 3–5 | Hybrid

Prepare

- Review the online student material. Use a projector to share this material with your students during the lesson.
- Make sure that you've covered ways of recognizing patterns in motion in an earlier lesson.
- Consider the abilities and backgrounds of all of your students. Differentiate the lesson to make it accessible to everyone. See the *Differentiation* section below for suggestions.

Engage

(Whole Class, 5 Minutes)

- Watch the student video here or access it via the online student material.

- Facilitate a quick discussion about which forces your students have seen in action when playing sports like basketball or volleyball.

Teacher Support

Key objectives

Students will:

- Observe and measure an object's motion to recognize a pattern
- Record data and use it to make predictions

Things you will need

- LEGO® Education BricQ Motion Essential Set (one for every two students)

Additional resources

Building instructions book "B," pages 20 – 38
Student Worksheet
Assessment Rubric

Educational standards

- NGSS 3-PS2-2
- ISTE: 4c,7c
- CCSS.ELA-LITERACY.SL.1 Lesson extension
- CCSS.MATH.CONTENT.3.MD.B.4

Hybrid learning resources

Personal Learning Kit lesson plan

- Ask questions, like:
  - Which force(s) makes the ball move? *(Push/Pull)*
  - Which force makes the ball come back down? *(Gravity)*
  - What's a "three-pointer?" *(A" three-pointer" is scored from any basket shot taken from outside the three-point line.)*
- Tell the students that they'll be building a basketball model, which they'll use in experiments to recognize a pattern in the motion of a ball.
- Distribute a set to each group.

Explore

(Small Groups, 25 Minutes)

- Have students work in pairs to build the Free Throw model. Tell them to take turns, one partner searching for the bricks while the other builds, switching roles after each step has been done.
- You can find support for building in the *Tips* section below.

Experiment 1:

- Have the students test their models to see if they can score a basket with the model set to pivot position 1, throw distance 2, and basket height 1 on the blue numbered tiles.
- Ask them to record the results on their Student Worksheets (Teacher Support – Additional Resources).
  - Now have them try to score again by increasing the throw distance to positions 4, 6, and 8.
  - Remind them to record the results of each test.

Explain

(Whole Class, 10 Minutes)

- Gather your students together to share what they've learned.
- Ask questions, like:
    - When was the force balanced/unbalanced? *(When the throwing arm is still, the force is balanced. When it's let go, the weighted brick drops and the force on the ball will become unbalanced. The force will remain unbalanced until the ball and throwing arm have stopped moving).*
    - What makes the weighted brick fall? *(Gravity)*
    - Why were you able to score every time whenever the basket height was set to position 1?
    - What do you think would happen if you increased the height of the basket?

Experiment 2:

- Now ask your students to set the height of the basket to position 2 and try to score from throw distance positions 2, 4, 6, and 8.
    - Tell them to record the results of each attempt in the second row of the table on their Student Worksheets.
    - Encourage them to predict from how far away they'll be able to score each time they change the basket height, marking their predictions in the table with an "X."
    - If they complete the column, or can no longer score a basket, have them raise the height of the basket to position 3, 4,

etc., and continue to record their results in the table until they can no longer score.

Elaborate

(Whole Class, 5 Minutes)

- Gather your students together to review and discuss their experiments.
- Ask questions, like:
  - What patterns did you recognize in the motion of the ball as the distance changed for each basket height? *(As the distance and height increased, it became more difficult to score a basket.)*
  - Hold up your table and look around the room. How does your table compare to the rest of the class?
  - Where you able to predict what would happen next?
- Allow time for the students to disassemble their models, sort the bricks back into the trays, and clean up their workstations.

Did you know that the LEGO Group now makes some LEGO elements from plant-based plastic? Elements including trees, leaves, dragons' wings, and basketball hoops are now made from sustainably sourced sugarcane. By 2030, all LEGO elements will be made from sustainably sourced materials.

Evaluate

(Ongoing Throughout the Lesson)

- Ask guiding questions to encourage your students to "think aloud" and explain their thought processes and reasoning in the problem-solving decisions they've made when building their models.

Observation Checklist

- Measure your students' proficiency in describing the pattern in the motion of an object and how this pattern can be used to predict future motion.
- Create a scale that matches your needs. For example:
    1. Needs additional support
    2. Can work Independently
    3. Can teach others

Self-Assessment

- Have each student choose the brick that they feel best represents their performance:
    - Green: I think I can recognize a pattern in the ball's motion.
    - Blue: I can recognize a pattern in the ball's motion.
    - Purple: I can recognize a pattern in the ball's motion, use this pattern to predict its future motion, and I can help a friend understand, too.

Peer-Feedback

- In their teams, have the students discuss their experiences working together.
- Encourage them to use statements like:
    - I liked it when you....
    - I'd like to hear more about how you....

Tips

Model Tips

- Show your students how to count the studs on the plates to help them place the bricks correctly. Point out that they should pay attention to where the two yellow throwing arm supports are placed on the white plate.
- Explain that the red axles indicate the variables that can be adjusted on the model *(i.e., basket height, throw distance, and pivot position).*
- Mention that distance between the basket and the throwing arm can be increased by turning the crank handle at the center of the model.
- Highlight that the string on the ball will help keep it attached to the model.

Differentiation

Simplify this lesson by:

- Having students try to score only from distance positions 2, 4, and 6

Increase the difficulty by:

- Asking your students to change the pivot point to "2," and then recording their observations in a new table
- Having the students set the basket height to "5" and challenging them to modify their models to score a three-pointer from any

distance between 1 and 8; this will involve some free-building

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Extensions

(Note: This will require additional time.)
To incorporate math skills development, and explore conventional units of measure, have your students hold a ruler to their models as they change the variables.

CCSS.MATH.CONTENT.3.MD.B.4

1:1 Hybrid Learning

Download the Personal Learning Kit lesson plan from the hybrid learning resources.