

Be a **Health Scientist!**

# Be an Athletic Trainer

## *Educator Guide*

*Big Question:*

*How do athletic trainers identify problems with athletes' muscles and joints and find ways to solve them?*



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# Be a Health Scientist! Big Ideas

These are the themes you'll find running through all five *Be a Health Scientist!* activities.

▶ **Health Science is all about finding ways to keep people healthy and helping them get better when they are sick.**

- *What are some ways people can stay healthy?*
- *How can we learn more about the spread of germs and diseases?*
- *What are some ways to help people get better when they are sick?*

▶ **The human body is complex. There are many parts that work together to protect us from sickness and work to keep us healthy. When those parts are unable to do their job, health scientists can help in a variety of ways:**

- *Finding the cause of the problem through tests and identifying ways to fix it.*
- *Using specially designed equipment to help our body work.*
- *Making sure our body has what it needs to stay healthy.*

## Core Four Strategies

Use the Core Four Strategies as you guide your learners through this activity.

- **Ask questions** to spark curiosity and encourage new ideas
- **Encourage scientific thinking** with chances to observe, make predictions, and test ideas
- **Cultivate rich dialogue** with chances to talk together, share ideas, and use science words
- **Make connections** between learners' experiences, science careers, and this activity



**Ask Questions**



**Encourage Scientific Thinking**



**Cultivate Rich Dialogue**



**Make Connections**

# Be an Athletic Trainer

*Big Question: How do athletic trainers identify problems with athletes' muscles and joints and find ways to solve them?*

## MATERIALS:

### Per group of 3–4 learners:

- Knee model (see Prepare section below):
  - Cardboard tubes (2)
  - Plastic ball (1)
  - Brass paper fasteners (4)
  - Duct tape
  - Pipe cleaners (1–2)
  - Rubber bands (1–3)
  - Knee-high stocking (1)
- Goniometer
- Set of 8 exercise cards



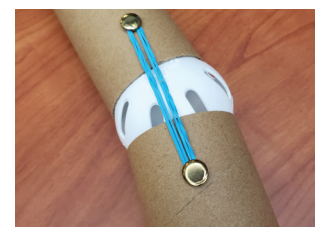
### Per class:

- Be an Athletic Trainer career card
- Lab notebooks
- Pencils
- Science skills stickers
- (Optional) additional pipe cleaners and rubber bands

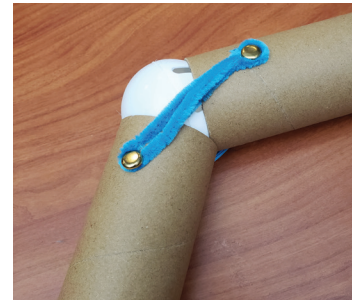
## Prepare

Assemble five knee joint models:

1. If the cardboard tubes do not already have pre-punched holes at one end, make them using a ball-point pen or other sharp implement. Measure about one inch from top edge of the tube and punch a hole through the tube wall. Add a second hole directly opposite the first hole.
2. Put a brass fastener through each hole and place a piece of duct tape over the prongs on the back side to hold it in place.
3. Place two cardboard tubes end-to-end, brass fastener sides together, with a plastic ball sandwiched between the tube ends.
4. Each knee model will have a different set of connections holding it together, representing different arrangements of muscles and ligaments in the knee:
  - **Sturdy knee:** On each side, wrap a pipe cleaner securely from the brass fastener on one tube to the brass fastener on the other tube. Test it using the “wobble test” described in the Explore section. The top tube should have minimal sideways movement. Tighten the pipe cleaners as needed until the knee is sturdy.
  - **One-sided weakness:** Use a pipe cleaner on one side as above. On the other side, use a rubber band. Wrap the rubber band once or twice as needed, so it is sturdy enough to hold the tubes and ball together but flexible enough to create some sideways “wobble” when tested.
  - **Two-sided weakness:** Use rubber bands as above, but on both sides.



- **One-sided tightness:** Use a pipe cleaner on one side like the sturdy knee above. Then bend the knee model to about a 45-degree angle. Add a pipe cleaner to the other side in this bent position, wrapping it as tightly as possible. This should shorten the length of the connection and make it harder for the knee to straighten fully.
  - **Two-sided tightness:** Add pipe cleaners to both sides in the bent (45-degree) position.
5. Pull a knee-high stocking over the model to hold all the pieces in place and add a rubber band around the top edge to secure it.
  6. Write a number, or a made-up patient name, in a visible location on each model so learners can tell them apart.



## Engage (~10min)

1. Introduce the athletic trainer career by showing the group the career card and asking questions to encourage learners to think about what an athletic trainer might do:
  - ▶ *What do you notice about this picture? What do you think this person is doing?*
  - ▶ *What does the name “athletic trainer” make you think of? What do you think they might do or study?*
2. Explain that athletic trainers specialize in helping athletes keep their muscles, bones, and joints working properly.
  - ▶ *Why do you think athletes need to pay special attention to their joints and muscles?*
  - ▶ *Have you ever seen or heard of someone who got injured while playing sports?*
  - ▶ *What happens when someone gets hurt on the field?*



3. Introduce the storyline:

- We are athletic trainers working for a basketball team. It’s the beginning of the training season, and a few players have been having problems with their knees.
- **Our job is to figure out what is causing the problem in each of their knees.**
- Then we’ll need to suggest the best training exercises for each player to help them improve their knee.

## Explore (~40min)

### Part 1: Research

1. Invite the group to start by exploring the structure and movement of their own knees. Try some or all of these activities:
  - Feel around your knee. Notice where it is hard and where it is soft.
    - ▶ *How does it change if you bend or straighten it?*
    - ▶ *Which parts do you think could be bones?*
    - ▶ *Which parts could be muscles or the parts that connect them?*

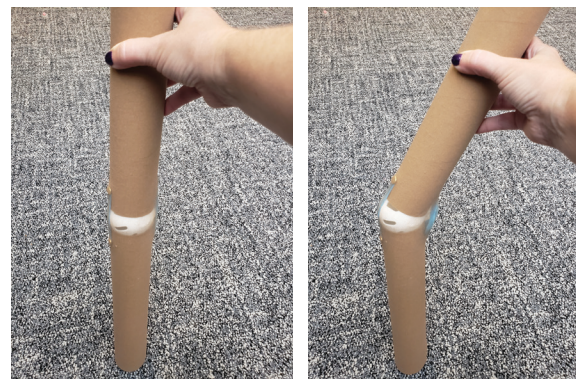
- Bend and straighten your legs while standing on both feet, then on one foot. Notice which directions the knee can bend, and which it can't.
  - Try to bend sideways at the knee while standing or holding your leg out straight—and without twisting the hip. Can you do it? (*Spoiler: No!*)
  - Test the movement of other joints like hip, ankle, shoulder, or elbow. Which ones can rotate in a circle, and which move mostly in one direction like a hinge?
2. Introduce the goniometer (pronounced "goh-nee-AHM-uh-ter"). Explain that it is a tool for measuring how joints bend, and we'll be using it to figure out the problems with our players' knees. Demonstrate how to use the goniometer:
    - Line up the center circle with place where the joint bends
    - Line up the top and bottom legs of the goniometer with the upper and lower parts of the limb
    - Read the number on the center dial to find out the degree of bend: 0 is completely straight; higher numbers mean a bigger bend.

*Learners who have difficulty reading the numbers may also just observe the angle of the legs visually to compare the degree of bend.*

3. Divide the group into teams of 3–4. Give a goniometer to each team and invite them to take turns practicing with the goniometers on each other. Suggest that they test elbows or knees (or both) as they feel comfortable.
  - ▶ *What do you notice about how far your elbows and knees bend?*
  - ▶ *What similarities or differences did you notice between you?*

## Part 2: Knee Testing

1. Explain that we will be using **models** of our players' knees to help us figure out what the problems are. Use one of the models to demonstrate how it bends, which end is the "foot," etc.
2. Explain that there are two things we want to test about each of our players' knees: how well they can straighten, and how stable they are.
  - A knee that can't straighten fully has muscles that are too tight and needs stretching exercises for flexibility.
  - A knee that is wobbly or bends in directions it shouldn't has muscles that are too weak and needs strengthening exercises.
3. Use one of the models to demonstrate each test:
  - Straightness test:
    - Stand the "foot" of the model on a hard surface.
    - Straighten the knee model as far as it can go without pushing or forcing.
    - Measure the angle of the knee on the side, using the goniometer. If the angle is larger than 0, the muscles are too tight and need stretching.
  - Side-wobble test
    - Stand the "foot" of the model on a hard surface.
    - Press down gently on the top of the model (the "thigh") and try to tilt it sideways, first to one side and then the other.
    - Measure the angle of tilt in the knee from the front. If the upper leg tilts and the knee bulges to one side, the muscles are too weak on that side and need strengthening. The bigger the angle, the weaker the muscle is.



4. Give each team one knee model to start. Direct them to perform the two tests on their “patient” and encourage them to record the results in the chart on page 5 of their lab notebook.

*The parts of the knee model may start to come loose if the knee is handled too forcefully. Remind learners to treat the model gently, like a patient—moving the knee too roughly or pushing it farther than it can easily go might make the injury worse!*

- ▶ *What happened when you tried that test? What results did you get?*
  - ▶ *What does it tell you about this player’s knee? Was it healthy, or do you see a problem?*
5. As time allows, rotate the knee models so teams can test and compare different “patients.” They can use the charts on page 6 of their notebooks to record their results.

### Part 3: Training Plan

1. Explain that now that we’ve figured out what the problems with our players’ knees are, we need to recommend a training plan with some exercises to help them get better.
  - ▶ *How can we tell which kinds of exercises different players might need?*

*For younger learners: Instead of developing specific training plans, you could try doing some of the exercises on the cards, and then have a brief discussion of which ones they think would be good for the players.*

- ▶ *Have you ever done any exercises that you think would be good for strengthening knees that are weak? What about stretching knees that are tight?*
2. Distribute the exercise cards to each team. Invite them to try doing the different exercises on the cards and decide which ones they think would be best for stretching, or strengthening, or both.
    - **Note:** Suggested answers are in the Background section below, but be open to alternative interpretations if learners can provide reasonable explanations for their choices.
  3. Challenge teams to create a specific warm-up routine using the exercise cards, by choosing the exercises they recommend and placing the cards in the order the exercises should be done. They could also write in their lab notebooks how many sets and repetitions they think each exercise should have (for example, 3 sets of 5 repetitions.)
    - **Option 1:** Create a routine for **one player** whose knee they tested, focusing on exercises for that player’s specific problems.
    - **Option 2:** Create a routine for **the whole basketball team**, making sure it includes exercises that will help the problems of each of the players they tested.

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### Reflect (~10min)

1. Gather the whole group together. Invite learners to reflect on the process they went through diagnosing their model knees.
  - ▶ *What did you find out from the tests you did on these knees?*
  - ▶ *What parts were easiest to figure out, and what parts were harder?*
  - ▶ *What should we tell these players about what we think the problems are with their knees?*



2. Discuss their plans for a warm-up routine.
  - ▶ *Why did you choose certain exercises for your warm-up plan?*
  - ▶ *How did you decide on the number of sets and reps?*
  - ▶ *What do you think is important for our patients to think about during their warm-up exercises?*
3. Encourage the group to reflect on how they were like an athletic trainer during the activity. Refer to the career card and the science skills stickers:
  - ▶ *What are some of the things we did today as an athletic trainer?*
  - ▶ *How did we think like scientists? What science skills did we use?*
  - ▶ *What did you do today that made you feel like a scientist?*
4. Allow time for learners to draw or write their reflections on page 7 of their lab notebooks. Invite them to choose a science skills sticker that reflects a skill they used and add it to their notebooks.

## Extend

For older learners: Challenge teams to adapt the knee models to represent other possible knee problems. Encourage them to think about other ways that a knee might have problems with stability or flexibility. Provide additional pipe cleaners and rubber bands and allow them to take apart and redesign the models to represent those problems. Invite them to trade their adapted models with another team and try to diagnose the other model's problem.

## Background

- **Athletic trainers** can work for individual athletes, but often they work for sports teams, collaborating with coaches, doctors, and physical therapists to help the team's athletes recover from injury and develop plans to prevent future injury.
- **Knees, like elbows, are hinge-type joints** that are designed to have a limited range of motion. The movements that allow you to move your lower leg or lower arm in a circle are actually coming from higher up in the hip or shoulder joints, which are ball-and-socket joints that can rotate more freely.
- **Knee injuries are especially common in sports like basketball, football, soccer, and skiing** that involve a lot of jumping, twisting, and quick changes of direction, because these activities put stress on the knee joint in other directions that can stretch or tear the muscles, ligaments, or tendons that support it.
- The **ACL** (anterior cruciate ligament) is a commonly injured part of the knee. It's a connector that holds the shin and thigh bones together and keeps them from twisting out of alignment. Twisting with too much force can cause the ACL to tear.
- The model we use in this activity is different from actual human knees in several ways:
  - The bones in actual knees **fit together directly like parts of a hinge**; there is nothing like the ball in the model for them to rotate around.
  - Actual knees have **multiple sets of muscles, tendons, and ligaments** connecting the bones together in different directions, rather than the two in our model.
  - Human knees have an additional bone, the **kneecap** or patella, that floats above the joint and protects the tendons inside it.
- Warming up loosens joints and increases blood flow to muscles, making them less likely to tear or twist during exercise. Cold muscles absorb less shock, which can lead to muscle strains, ligament tears, and tendon injuries. Warm-up exercises:
  - Backward Lunge (Stretching)
  - Balance Lunge (Stretching)
  - Hamstring Stretch (Stretching)
  - Squat (Stretching and strengthening)
  - Mountain Climber (Strengthening)
  - Jumping Jacks (Strengthening)
  - Star (Strengthening)
  - High Knee (Strengthening)

# Acknowledgments

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**Designers:** Madeleine Bennett and Madelyn Lobb

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## Be an Athletic Trainer Quick Guide

EDUCATORS DO:	EDUCATORS ASK:	LEARNERS DO:
<b>ENGAGE</b>		
<p><b>Introduce Career</b></p> <ul style="list-style-type: none"> <li>• Use career card</li> <li>• Ask discussion questions</li> <li>• Explain what athletic trainers do</li> </ul>	<p><i>What do you notice about this picture?</i></p> <p><i>What do you think this person is doing?</i></p> <p><i>What do you think an athletic trainer might do or study?</i></p>	<ul style="list-style-type: none"> <li>• Make observations about the image</li> <li>• Make connections to their own experience</li> <li>• Share their ideas</li> </ul>
<p><b>Introduce Story</b></p> <ul style="list-style-type: none"> <li>• We are athletic trainers at a college</li> <li>• Athletes on our basketball team are having knee problems and we need to figure out why</li> </ul>	<p><i>Why do you think athletes need to pay special attention to their joints and muscles?</i></p> <p><i>Have you ever seen or heard of someone who got injured while playing sports?</i></p> <p><i>What happens when someone gets hurt on the field?</i></p>	<ul style="list-style-type: none"> <li>• Imagine being an athletic trainer</li> <li>• Discuss why it is important to have trainers just for athletes</li> </ul>
<b>EXPLORE</b>		
<p><b>Part 1: Research</b></p> <ul style="list-style-type: none"> <li>• Guide group to explore their own knees</li> <li>• Demonstrate how to use goniometer</li> <li>• Divide group into teams to practice using goniometer</li> </ul>	<p><i>What parts of your knee might be bones? What parts are something else?</i></p> <p><i>Which directions does your knee bend? Which ways can't it bend?</i></p> <p><i>Which other joints can rotate in a circle, and which bend like a hinge?</i></p>	<ul style="list-style-type: none"> <li>• Observe structure &amp; movement of their knees</li> <li>• Practice measuring teammates' joint mobility with goniometers</li> </ul>

\*\*Quick Guide continues on the following page.

# Be an Athletic Trainer Quick Guide



EDUCATORS DO:	EDUCATORS ASK:	LEARNERS DO:
<p><b>Part 2: Knee Testing</b></p> <ul style="list-style-type: none"> <li>• Introduce knee models</li> <li>• Demonstrate straightness and side-wobble tests on model knee</li> <li>• Distribute knee models to teams</li> </ul>	<p><i>What happened when you tried that test?</i></p> <p><i>What results did you get?</i></p> <p><i>What does it tell you about this player's knee?</i></p> <p><i>Was it healthy, or do you see a problem?</i></p>	<ul style="list-style-type: none"> <li>• Perform straightness and side-wobble tests on model knee</li> <li>• Measure joint angle with goniometer</li> <li>• Identify possible joint problems based on test results</li> </ul>
<p><b>Part 3: Training Plan</b></p> <ul style="list-style-type: none"> <li>• Distribute exercise cards</li> <li>• Lead group in trying the exercises</li> <li>• Decide on type of plan needed (single player vs. whole team)</li> </ul>	<p><i>How can we tell which exercises different players might need?</i></p> <p><i>Which of these exercises would be good for strengthening knees that are weak?</i></p> <p><i>Which would be good for stretching knees that are tight?</i></p>	<ul style="list-style-type: none"> <li>• Try warm-up exercises</li> <li>• Evaluate exercise purposes</li> <li>• Choose and place cards to create a warm-up plan</li> </ul>
REFLECT		
<p><b>Share Group Results</b></p>	<p><i>What did you find out from the tests you did on these knees?</i></p> <p><i>Why did you choose certain exercises for your warm-up plan?</i></p> <p><i>What do you think is important for our patients to think about during their warm-up exercises?</i></p>	<ul style="list-style-type: none"> <li>• Share and compare results</li> <li>• Draw conclusions</li> </ul>
<p><b>Make Career Connections</b></p>	<p><i>What did you do today that made you feel like an athletic trainer?</i></p> <p><i>How did we think like scientists?</i></p> <p><i>What science skills did we use?</i></p>	<ul style="list-style-type: none"> <li>• Use skills stickers</li> <li>• Draw/write reflections</li> </ul>

# Notes

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