SEASON FOUR, ISSUE ONE

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DragonflyTV Educator's Guide

Pull out this booklet and use it to ignite inquiry in your classroom or club!

402/Engineering
Ice Bikes

404/Friction
Curling

403/Animal Behavior
Sea Lions

405/Sound
Volleyball

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HOW TO USE THIS GUIDE

1. Duplicate the DFTV student page of your choice (pp. 3–6), and distribute it to your students. Read the questions posed by the young scientists. Encourage your students to describe how they would investigate the questions. Guide them through the steps of developing an inquiry (see below).

2. If you have videotapes of the episodes featured in this guide, play the video segment to see how the DFTV kids investigated the questions and what their results were. The investigations are also described on page 7 of this guide and on the DragonflyTV Web site. Apply the ideas learned in the DFTV example to the classroom activity "Do It, Get To It," or encourage students to do the investigation described in "Take It Outside!"

3. If your students develop investigations of their own, encourage them to visit the DragonflyTV Web site, pbskids.org/dragonflytv, and click on DFTV Boards. Kids can describe their investigations, and share their ideas with others.

OBSERVATIONAL

1. Write the question: How does A compare to B? Make a hypothesis.
2. Decide what to measure or observe for both A and B and how to do it.
3. Make multiple observations when possible. Record all results.
4. Organize the data in a table or chart, looking for differences or similarities.
5. Write an answer to the original question. Also write down any new questions that come up during this investigation.

EXPERIMENTAL

1. Write the question: If I change A, what happens to B? Make a hypothesis.
2. Choose the independent variable (the thing you change) and dependent variable (the thing that is affected) and how to measure them.
3. Do multiple trials when possible.
4. Organize the data into a table, and prepare a graph. Look for patterns or trends.
5. Write an answer to the original question. Also write down any new questions that come up during this investigation.

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402 / Engineering: Ice Bikes

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Student Page

What's Up?

We're Bob and Brennan, and we're into a very cool, very slick sport: ice biking! Our school holds an annual ice bike race, where the goal is to design and build the winning bike. We know we want to modify one of last year's top models by adding studs to the tires. The studs will give us traction, kind of like cleats do on shoes. Our DragonflyTV question is: **How many studs should we add for maximum speed on ice?**

How Would You Investigate This Question?

Think about Bob and Brennan's idea of adding studs to the ice bike's tires. Do you think this is a good modification? If so, how many studs would you add? Will too many studs "crowd" the tire, actually slowing the bike down? What other design changes might you suggest to make a bike cruise quickly and safely across an icy surface? Think about other bicycle features, like the handlebars, seat, and frame. Write your ideas in your notebook and discuss them with your classmates. Then discuss them with your teacher, watch the DragonflyTV video, or go to pbskids.org/dragonflytv to see what Bob and Brennan did, what they learned about engineering, and finally, if their ice bike won the day!

Do It, Get To It

Do a friction study of your own. Get a board (like a plank or shelf) and some household objects to slide down the plank. Try things like a hockey puck, tissue box, soup can, CD case—anything that will slide, not roll. Lay the plank flat, set the object on one end of the plank, and lift the end slowly until the object begins to slide down the plank. Measure how high you have to raise the plank before each object slides. Before you begin, predict which things will slide at lower angles and which will slide at higher angles.

Take It Outside!

If you live where it snows, get outside with your snow sled and do some science! Find a good sliding hill, and make a sledding track in the snow. Do an experiment to see how the weight of the cargo in the sled affects how quickly it slides down the track. Start with an empty sled then fill it with more and more weight. Use a stopwatch to measure the times carefully. Don't have snow where you live? Try the same thing with cardboard on a grassy hillside!

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403 / Animal Behavior: Sea Lions

Student Page

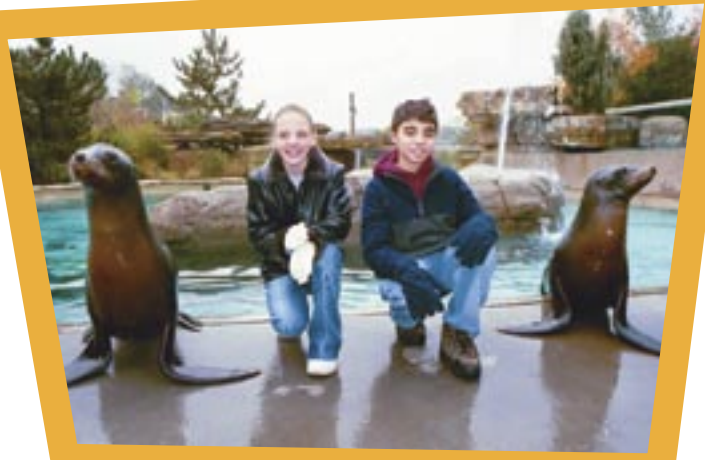
What's Up?

We're Robyn and Alex, and we love to visit the Pittsburgh Zoo & PPG Aquarium to hang out with our favorite creatures: sea lions! The zookeepers here want to make the animals feel like they are in the wild as much as possible. In the wild, sea lions spend much of the day hunting and playing. That got us wondering: **How could we give the sea lions more chances to play and hunt, just like they enjoy doing in their natural habitat?**

How Would You Investigate This Question?

To figure out how to create a realistic natural habitat for sea lions, make yourself familiar with how the creatures live in the wild. What sorts of information should you gather about their activities? What should you know about their diet? Write your ideas in your notebook and discuss them with your classmates. Then discuss them with your teacher, watch the DragonflyTV video, or go to pbskids.org/dragonflytv to see what Robyn and Alex did and what they learned about keeping their sea lion friends happy and healthy.

Do It, Get To It



Does your class have a pet guinea pig, hamster, or gerbil? Devise a test to determine their food preferences. Take regular hamster chow (the kind with lots of different seeds and grains) and sort the mixture into the different ingredients. Keep the sunflower seeds apart from the corn, apart from the millet seeds, etc. Put each type of seed into its own little dish. Place the dishes into the animal's cage. Then watch to see if the animal selects the seeds in one dish over the others. Repeat the observation for several days. What does your pet prefer?

Take It Outside!

Whether it's winter or summer, birds are always on the lookout for food. Some birds peck at seeds, others hunt for worms, and some even eat fruit or berries. Set up an observation experiment where you put out different kinds of bird food outside your window. Which kind of food attracts birds? Learn to identify the birds in your area. Is there a kind of food that attracts the most birds? Which food doesn't seem to attract any birds at all?

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404 / Friction: Curling

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Student Page

What's Up?

We're Mimi, Haley, Tara, and Lauren, and when we talk about curling, we don't mean hair! Curling, our favorite sport, involves sliding four heavy rocks down an icy surface at the center of a target. The team with the rock closest to the target's center scores a point. When we release the rock, we give it a bit of spin, so it curves a little, or "curls." This got us thinking: **How does the spin we put on the rocks affect where they go?**

How Would You Investigate This Question?

First, learn a little more about curling. What does the ice's surface look like? Is it smooth or bumpy, uphill or flat? How far away is the target and how big is it? What are the differences in brooms we use to sweep the ice? Once you've become a little more familiar with curling and its equipment, think about what tests you would devise to determine the most effective spin. Write your ideas in your notebook and discuss them with your classmates. Then discuss them with your teacher, watch the DragonflyTV video, or go to pbskids.org/dragonflytv to see what Mimi, Haley, Tara and Lauren did and what they leaned about the slippery art of curling.

Do It, Get To It

Find a smooth flat floor space in school, such as in the gym or cafeteria. Make "curling rocks" out of plastic food containers (like Tupperware). Attach a handle to the lid, like a curling rock has, so you can slide the container along the floor and give it a spin at the same time. Now, a curling rock that spins clockwise veers (or, curls) to the right; one that spins counterclockwise veers left. Do these containers curl just like curling rocks on ice?

Take It Outside!

Try an experiment with another object that spins... a flying disc. Most of us throw with our right hand, which gives the disc a clockwise spin. Try to find a way to throw it so it spins counterclockwise. What differences do you see in the disc's flight? Does it tend to veer one way or the other, depending on the spin? Is there no difference at all?

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405 / Sound: Volleyball

Student Page

What's Up?

We're Brittney and Maggie, and whether we're bumping, setting, or spiking, volleyball is our favorite game. Like any team activity, communication really helps. Sharing information and cheering on our teammates guides and motivates our teammates during this lightning-fast game. But how much is too much? Our DragonflyTV query is this: **Is talking on the court helpful or just plain distracting?**

How Would You Investigate This Question?

To find out how much on-court communication is best, think about the kinds of things volleyball players would talk about. Do they shout directions, identify the ball's location, or just offer encouragement? What kinds of things might they say? What kind of communication is most helpful in other sports? How could you test these ideas on a court, field, or other location? Write your ideas in your notebook and discuss them with your classmates. Then discuss them with your teacher, watch the DragonflyTV video, or go to pbskids.org/dragonflytv to see what Brittney and Maggie learned about chatter on the court.

Do It, Get To It

Some people can "filter out" distracting sounds better than others. Get a group of friends and try an experiment. Have one friend be the listener and three other friends be the talkers. Two of the talkers will each recite a different fairy tale. The third talker will tell an unfamiliar story. When you are ready to begin, have all three talkers start talking on top of each other. The listener closes her eyes and tries to listen to the unfamiliar story, filtering out the other talkers. After two minutes of chatter, everybody stops talking, and the listener tries to re-tell the unfamiliar story. How many details will she get? Why?

Take It Outside!

Remember the trick of talking to someone using two cups and a long string? Remember the game of "telephone," where you pass a message along from person-to-person, and by the end the message comes out completely different? Try an experiment using both games! Make a set of several cups-and-string communicators. Get some friends and spread out. Make sure there is a cup-and-string communicator between each pair of people. Have the first person start a message through the cup-and-string to the next person. The second person continues the message to the next player through the next cup-and-string, and so on. How effective is this communication method? Can you improve the results in any way?

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About the DFTV Investigations
(for the educator)

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Educator Page

ICE BIKES

NATIONAL SCIENCE EDUCATION STANDARD

Science and Technology Grades K–4:
Understanding about Science and Technology
Physical Science Grades 5–8:
Motions and Forces

The boys acquired three rubber tires, installing 50 studs in the first, 100 studs in the second, and 150 studs in the third. They recorded the time it took to go around a 200 meter ice track once from a complete stop, doing several trials for each tire. For the conditions of the track (wet and slushy), they found the 100-stud tire gave them the shortest race time, and the most control.

As with many technology investigations, one looks for trade-offs. More isn't always better. Discuss with students the importance of identifying the limits of a technological innovation.

SEA LIONS

NATIONAL SCIENCE EDUCATION STANDARD

Life Science Grades K–4:
Organisms and Environments
Life Science Grades 5–8:
Regulations and Behavior

Robyn and Alex received permission from the zoo to select three types of fish to feed the sea lions at the next three feedings: frozen fish; small live trout; large live trout. They kept the weight of fish the same at each feeding, and recorded the time for the sea lions to consume all the fish. They also observed the sea lions for ten minutes after feeding, to monitor their activity levels. They found that feeding the sea lions live fish induced positive behaviors, keeping the sea lions active and alert. Discuss the challenges in controlling variables when conducted investigations into animal behavior. Time of day, age of the animal, changes in the animal's routine can all influence the observations one makes.

CURLING

NATIONAL SCIENCE EDUCATION STANDARD

Physical Science Grades K–4:
Motion of Objects
Physical Science Grades 5–8:
Motions and Forces

The girls first looked for the relationship between the direction of rotation of the curling rock and the direction of its curl. Secondly, they investigated the effect that sweeping has on the rock's motion. They used a digital laser timer to gauge the speed of the rock, then measure the distance of the slide, either sweeping it or not. They compared swept and unswept rocks of similar initial speed, and found that all rocks, regardless of speed, glide farther when the ice in front of them is swept. Encourage your students to look for science investigations in the sports they enjoy.

VOLLEYBALL

NATIONAL SCIENCE EDUCATION STANDARD

Life Science Grades K–4:
Organisms and Environments
Life Science Grades 5–8:
Regulations and Behavior

The girls scrimmaged with another team to test whether the number of players communicating influenced their team's success. They played ten serves where no player talked, ten serves where only the captain talked, and ten serves where all six players talked. They found that they did win more volleys once everyone was communicating, although they were aware that this is a skill that comes with practice.

Human behavior experiments are difficult to conduct, given all the factors that can influence an outcome. This investigation is a good example of a non-traditional investigation relating to a popular sport. Encourage your students to develop other creative investigations like this one.

For more details on these investigations, visit pbskids.org/dragonflytv.
Use the search option to quickly find the specific segment.

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Here's how the DragonflyTV investigations of Season 4 align with the National Science Education Standards (NSES), Grades 5–8.

Investigation	Show #	Subject Area	NSES
Fencing	401	Physical Science	Transfer of energy
Martial Arts	401	Life Science	Structure and function in living systems
Ice Bike	402	Technology	Understandings about science and technology
Robot War	402	Technology	Understandings about science and technology
Rabbits	403	Life Science	Regulation and behavior
Sea Lions	403	Life Science	Regulation and behavior
Curling	404	Physical Science	Motions and forces
Hovercraft	404	Technology	Understandings about science and technology
Volleyball	405	Nature of Science	Nature of science
Extreme Sounds	405	Physical Science	Transfer of energy
Wolves	406	Life Science	Populations and ecosystems
Sled Dogs	406	Life Science	Regulation and behavior
Jump Rope	407	Life Science	Regulation and behavior
Perception	407	Life Science	Regulation and behavior
Rivers	408	Earth Science	Earth's history
Sand Dunes	408	Earth Science	Structure of the earth system
Tigers and Otters	409	Life Science	Regulation and behavior
Prairie Dog Calls	409	Life Science	Regulation and behavior
Lip Gloss	410	Physical Science	Properties of matter
Forensics	410	Physical Science	Properties of matter
Diving	411	Technology	Understandings about science and technology
Ski Jumping	411	Physical Science	Motions and forces
Cheetahs	412	Life Science	Populations and ecosystems
Baby Animals	412	Life Science	Reproduction and heredity
Trebuchets	413	Technology	Understandings about science and technology
Kart Racing	413	Technology	Understandings about science and technology

Visit Great Plains National at www.gpn.unl.edu or call 1-800-228-4630 to order videotapes of DragonflyTV. Each program includes authentic investigations, supported by Educator's Guides that will get your students doing their own inquiries. Each program is described in detail at pbskids.org/dragonflytv.

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