Pull-out Section

# DragonflyTV Educator's Guide

**For use in classrooms, afterschool clubs, youth groups, museums, zoos, and more.**

DragonflyTV, PBS's science show for kids 9–12, highlights kids dreaming, developing, and doing their own inquiry-based investigations. Now you can use DragonflyTV Educator's Guides to share this scientific energy with your students!

These Educator's Guides are based on DragonflyTV investigations. Please enjoy using, modifying, and tailoring these materials, which will be featured in National Science Teachers Association publications and on our Web site at www.dragonflytv.org.

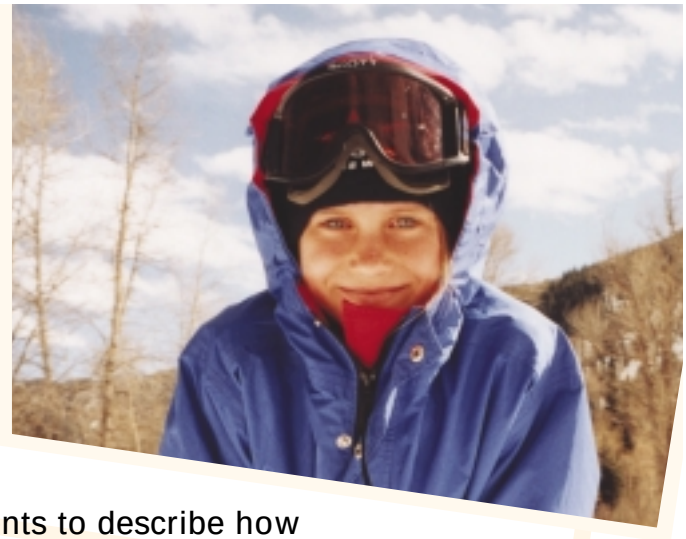
**Educators can tape DragonflyTV broadcasts and use the videos in classrooms, clubs, and other institutions for a full year.**

To learn more about DragonflyTV, go to www.dragonflytv.org.

SEASON TWO, ISSUE ONE




DragonflyTV is a production of Twin Cities Public Television (TPT), St. Paul/Minneapolis, and is made possible by major grants from Best Buy Children's Foundation and the National Science Foundation.



# HOW TO USE THIS GUIDE

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

If you have a videotape of the episode, play it to see how the DFTV scientists investigated the question, 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."

If your students develop investigations of their own, encourage them to visit the DragonflyTV Web site, www.dragonflytv.org. On the link titled "Be on DFTV" they can describe their investigation and they’ll be considered for the next season of DragonflyTV!

## 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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# 201 / INVESTIGATE: Which animals grow the fastest?

## What's Up?

We're Matt and Kyndal. Whether they have fur or feathers, we love animals. When we went to the zoo in the springtime with our friend Danny, we noticed a lot of newborn animals. We knew they wouldn't stay small for long and were curious about which animal grows the fastest. For our DragonflyTV investigation, we tracked the growth of a chicken, a pig, and a cow. Which do you think grew the fastest?

**HOW WOULD YOU INVESTIGATE THIS QUESTION?**
Decide what you're going to measure and how often you'll measure it. What does it mean to "grow faster?" How would you display your results? Describe your investigation in your notebook, and discuss it with your teacher, or go to www.dragonflytv.org to learn what Matt, Kyndal, and Danny discovered.

## Do It, Get To It

**GO AHEAD, OPEN A CAN OF WORMS!**
Investigate how mealworms respond to different stimuli, such as touch, sound, light, or scents. (Ask your teacher for help getting a supply of mealworms.) How do they react to light? Put a worm on a table, shine a light on it, and see if it turns to or away from the light. Or place a smelly piece of food next to a worm and see if it moves toward the food or away from it. Devise similar tests, and track the worms' responses. After the testing is completed, watch the mealworm metamorphose into a beetle. What differences do you notice about how the mealworm and the beetle respond to those stimuli? Can you explain why they would be different?

## Take It Outside!

**BIRD BRAINS**
Set up three birdfeeders near a window, and fill them each with a different type of feed, such as sunflower seeds, cracked corn, and millet. Track what kinds of birds (and other creatures!) visit which feeders. Does weather make a difference? What other factors affect how many birds come to your feeders? If you want to participate in a national study of birds, visit the Cornell Lab of Ornithology, at http://birds.cornell.edu/publications/birdscope/Spring2001/urbanbirds.html

Student Page



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# 202 / STRUCTURES: Can a snow shelter keep you warm?

## What's Up?

We're Morgan, Thianna, and Rio, and we dig SNOW! Not only do we dig it, we jump in it, ski on it, and snowboard over it. But snow isn't all fun and games. Getting stranded in snow and freezing cold weather can be really dangerous. We built a snow shelter called a quinzhee. It's actually a little cave you dig in a big mound of snow. But we weren't sure it would really keep us warm overnight. For our segment on DragonflyTV we asked: Will a snow shelter keep you warm when the temperature dips below freezing?

**HOW WOULD YOU INVESTIGATE THIS QUESTION?**
What equipment would you need? How would you keep track of the temperature both inside and outside the snow shelter? Write your ideas in your notebook, then discuss them with your class or visit www.dragonflytv.org to see what the DFTV scientists found out.

## Do It, Get To It

**FREEZE OUT!**
All materials have different insulating abilities to keep hot things hot and cold things cold. Glass, paper, plastic, and metal all are different. What materials make the best insulators? Find three containers made of different materials and compare their insulating properties.

**1.** Put equal numbers of equal-sized ice cubes into each container (if you live in a snowy climate, you could put equal masses of snow into each container).

**2.** Put all three containers in a warm part of the classroom. Record the time of day when you start.

**3.** Inspect all cups periodically, recording the time when the ice or snow is completely melted.

**4.** Record your findings in a chart or graph. What did you discover?

## Take It Outside!

**CLOUDY LOGIC**
We all know that clouds are cool, but did you know that they can keep things cool? They can also warm things up! Clouds have an insulating effect on the earth. Design an investigation where you relate the cloud cover where you live to the daytime and overnight temperatures. Here's how: Record the evening air temperature at 8 p.m., and the morning temperature at 8 a.m. Record the cloud conditions you see each time. Also, watch the TV weather forecast to find out if any weather fronts moved through. Do this for seven days in a row. How many degrees does the air temperature go up on a sunny day compared to a cloudy day? How many degrees does it drop on a cloudy night compared to a sunny night? Can you determine if the temperature changes were due to the clouds, or due to a passing weather front?

Student Page



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# 203 / SPORTS SCIENCE: How do I kick a soccer ball farther?

## What's Up?

I'm Dana, and I get my kicks playing soccer. I'm a strong player, but I want to figure out how to really boot the ball the length of the field! My question: if your legs are bigger, can you always kick the ball farther? For my DragonflyTV investigation, I invented a machine to answer this question.

**HOW WOULD YOU INVESTIGATE THIS QUESTION?**
Brainstorm with other students ways to build a machine that can kick a soccer ball. Draw a design of your machine in your notebook, and share it with the class. You can also go to www.dragonflytv.org to see Dana's machine and find out what she discovered.

## Do It, Get To It

**THAT'S THE WAY THE BALL BOUNCES!**
Pressure certainly makes us behave in certain ways, but did you know it also affects basketballs and volleyballs? Pressure is the push of the air on the surface of the ball, both inside and out. Air pressure inside a basketball or volleyball changes the way it bounces. Design an investigation to show this influence. Your gym teacher might have an air pump with a pressure gauge on it. Measure how the ball bounces when you drop it from a certain height. Also, ask a friend to dribble the basketball (or serve the volleyball), and get his or her feedback about how well the ball performs when inflated to different pressures. What is the best pressure to inflate the ball? How will you decide? Is more air pressure always better?

## Take It Outside!

**GOING BATTY**
How do you choose the right baseball bat for you? Baseball bats come in many different lengths and weights. Design an investigation where you and a friend test some different bats. Set up a ball on a tee, and swing different bats. You could measure how far the ball flies, or how accurately the batter hits the ball. Make a scatter-chart showing where the ball landed. Can you see differences in the scatter-chart for short bats compared to long ones, or heavy versus light ones? What features are best for one particular person? Relate bat choice to the person's height or arm length.

Student Page



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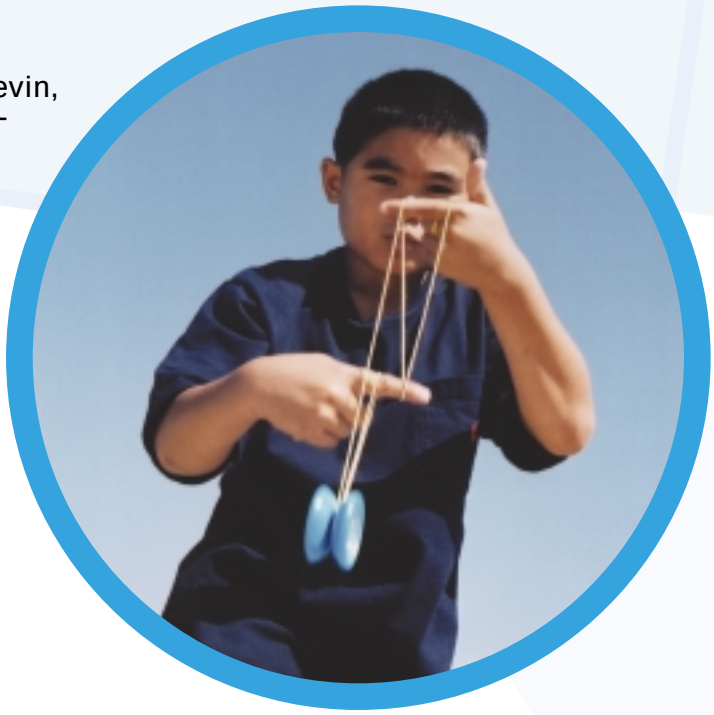
# 204 / SPINNING: What makes a yo-yo sleep?

## What's Up?



Yo! I'm John, and I love yo-yos! When my friends Kevin, Minna, and I are doing tricks, one of the most important skills to master is making our yo-yos "sleep." Sleeping is when you throw the yo-yo just right, and it keeps spinning when it reaches the end of the string without climbing back up. Since we want to perfect our tricks, we asked this question on DragonflyTV: How can we change our yo-yos to increase their "sleeping time?"

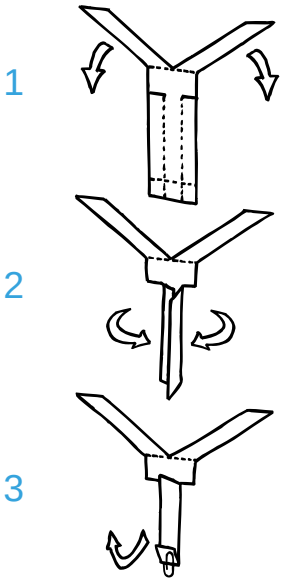
**HOW WOULD YOU INVESTIGATE THIS QUESTION?**
Look at several kinds of yo-yos. Some have ball bearings, others do not. Pick one kind of yo-yo, the variables you want to investigate, and describe what experiments you'd do. Write your investigation in your notebook, or go to www.dragonflytv.org to find out what John and his friends did.

## Do It, Get To It

**TOP THIS**
There's a lot of science in simple toys, even a top. Make a simple top out of a pencil or toothpick and heavy paper. Try to find a design that spins a long time without tipping over. Try long and short pencils, or different shapes of paper. Test other variables like the mass of the whole top. Design an experiment to find the characteristics that produce the longest spinning top! Be sure to record your findings, and think about why certain designs make for better spinning.

## Take It Outside!

**CREATE-A-CHOPPER**
Make a simple paper helicopter, like in the diagram to the right:




Now create an investigation that tells you how to design your helicopter to do the following things:
a) spin quickly, or spin slowly
b) drop slowly;
c) different combinations of the options above.

Try changing things like the length of the propeller arms; the width of the propeller arms; and the weight of the body. What happens?

Hold a helicopter drop contest. Find a safe place from which to drop your helicopters, and try to make them land in a target circle.

Student Page



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# About the DFTV Investigations (for the educator)

## SNOW SHELTER

**NATIONAL SCIENCE EDUCATION STANDARD**

**Earth Science Grades K–4:**
*Properties of Earth Materials*
**Physical Science Grades 5–8:**
*Transfer of Energy*

The DFTV scientists built a snow shelter (quinzhee), and used an electronic thermometer to record the temperatures inside and outside all night long. They found that even though the outside air temperature dipped to a chilly 20° Fahrenheit (-6° C), the temperature inside stayed a comfortable 32° Fahrenheit (0° C). Their body heat kept the inside air temperature warm, and the quinzhee wall kept the heat in!

Get your students thinking about why the temperature inside didn't climb above 33° Fahrenheit (1° C) degrees, or what result you might get if nobody stayed inside during the night. For more details about this investigation, visit www.dragonflytv.org.

## YO-YOS

**NATIONAL SCIENCE EDUCATION STANDARD**

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

The DFTV scientists tried three different lengths of string (24", 36", 48" or 60 cm, 90 cm, 120 cm) on their yo-yos, and measured the sleep time in each case, doing several trials to get an average. They found that the 48" strings gave a longer sleep time than the other two. Strings longer than 48" were too hard to control to be useful. The longer string allows more rotational energy to develop, giving the yo-yo a longer sleep time.

There are other yo-yo properties to consider, too, like mass, axle bearing, and shape, all of which can influence the yo-yo's rotational inertia. For more details about this investigation, visit www.dragonflytv.org.

## BABY ANIMALS

**NATIONAL SCIENCE EDUCATION STANDARD**

**Earth Science Grades K–4:**
*Life Cycles of Organisms*
**Physical Science Grades 5–8:**
*Reproduction and Heredity*

The DFTV scientists measured the weights of a chick, a pig, and a cow from birth until four weeks of age. The cow gained the most weight, but it didn't even double its birth weight. The pig increased its weight by seven times, and the chick beat them all by increasing its body weight 14 times! It appears that small animals grow at faster rates than large ones.

Work with your students to clarify the difference between absolute growth rate (pounds per month) and relative growth rate. For more details about this investigation, visit www.dragonflytv.org.

## SOCCER KICK

**NATIONAL SCIENCE EDUCATION STANDARD**

**Earth Science Grades K–4:**
*The Characteristics of Organisms*
**Physical Science Grades 5–8:**
*Structure and Function in Living Systems*

The girls built a spring-loaded soccer ball kicking machine out of 2x4's, and used springs to simulate leg muscles.The girls learned that the distance of the kick depends on the mass of the leg, *and* how quickly it swings.

This investigation illustrated not only the concept of transfer of momentum, but inertia as well. The girls didn't anticipate that the heavier leg's inertia required more "spring" muscle to make it swing fast. Use this investigation to discuss inertia, momentum and kinetic energy. For more details about this investigation, visit www.dragonflytv.org.

Teacher Page



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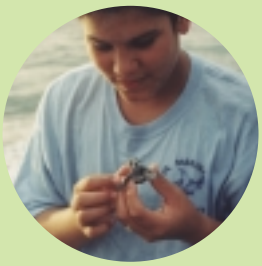
## DragonflyTV Season Two Themes

**201** - Investigate
**202** - Structures
**203** - Sports Science
**204** - Spinning
**205** - Propulsion
**206** - Human Body
**207** - Sound
**208** - Technology
**209** - Ecosystems
**210** - Mammals
**211** - Creepy Crawlies
**212** - Underwater
**213** - Planet Earth



**SEND HOME DFTV MAGAZINE WITH YOUR STUDENTS!**
Your students can explore hot science in the cold winter months with their own DFTV magazine. Jam-packed with model investigations from DragonflyTV, this notebook-sized, take-anywhere journal will offer hands-on activities to keep students learning, discovering, and having fun with science outside the classroom. DFTV magazine also features tips on how to ask questions, make observations, and gather data that will lead to real discovery. Plus, there are plenty of science games and puzzles to keep the fun going all winter long.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