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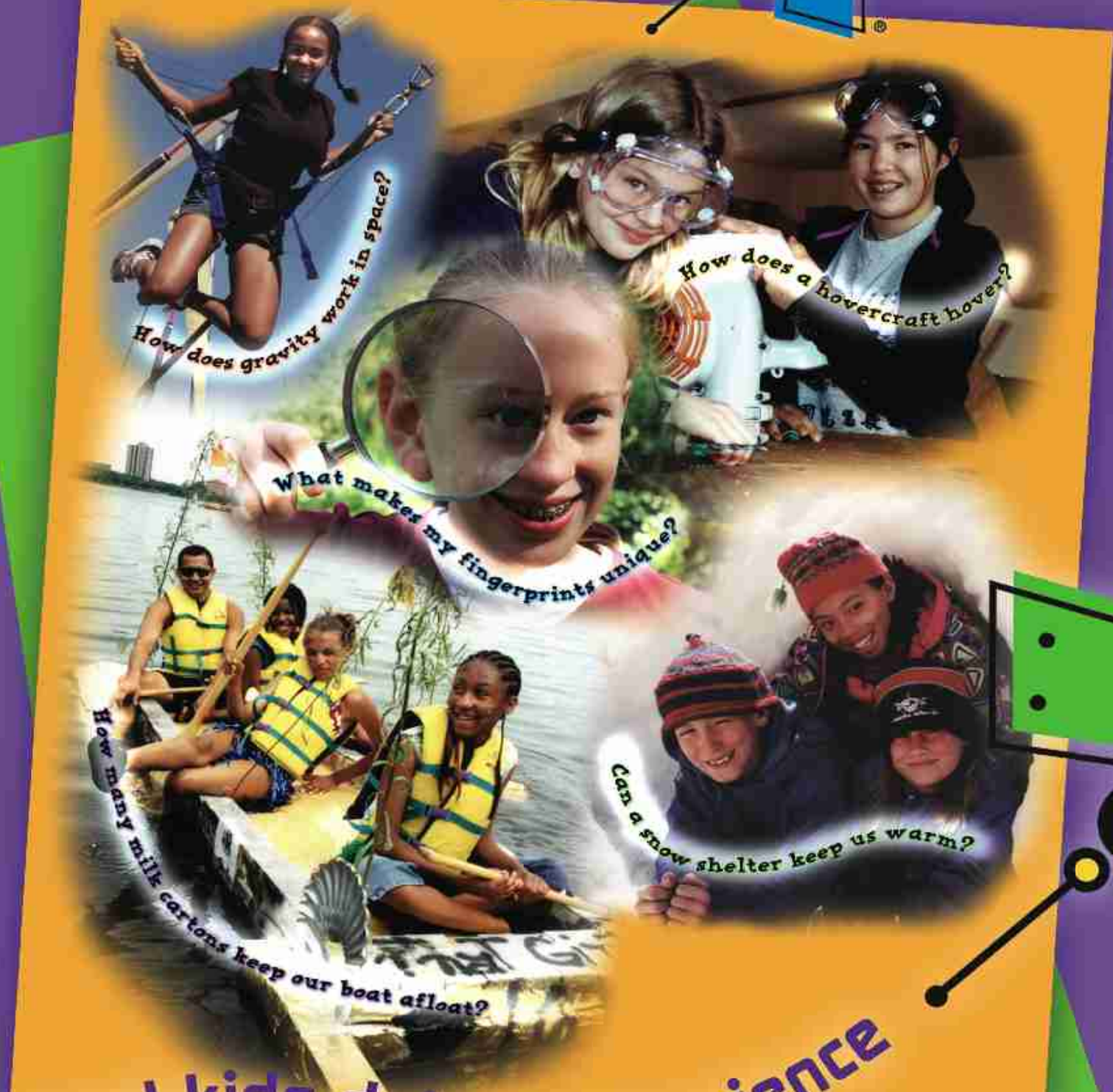

Real kids doing real science

BEST BUY Children's Foundation

tpt TWIN CITIES PUBLIC TELEVISION

SEE IT ON PBS KIDS

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HOW TO USE THIS GUIDE

Duplicate the student pages on the back of this poster, and distribute them to your students. Read the question posed by the DFTV scientists. Encourage your students to describe how they would investigate the question. Guide them through the steps of developing an inquiry.

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 the DFTV 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".

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.

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.

Student Page

302 / SPORTS SCIENCE:

How do different hockey sticks affect my shot speed and accuracy?

What's Up?

We're Tess, Alison, and Christina. Since we love hockey, we wanted to check out some slap-shot science. Most hockey sticks are made of wood, but some are made of graphite, even aluminum, and each has its own level of flexibility. The shaft of a hockey stick bends and springs back during a shot…that's called flex. We want to know: how does a hockey stick's flex affect our shooting power and accuracy?

Take the DFTV Challenge!

Come up with your own hockey stick investigation. Decide what kinds of stick to test, and how you'll measure your shot speed and accuracy. Think about how many times to do the test to get a meaningful result. Record your procedure and hypothesis in your science notebook. Go to www.dragonfly-tv.org to see what Tess, Alison, and Christina did for their investigation.

Do It, Get To It

Ever read the printing near the air valve on a basketball: "Inflate to 7 pounds"? What does that mean? What it means is that the pressure inside the ball should be 7 pounds per square inch, not that the ball should weigh 7 pounds. So does pumping up a ball change its weight at all? Get a basketball, football, or volleyball, an inflation needle, a scale from science class that can measure up to 2000 grams, and an air pump. Put the needle in the ball and let most of the air out. Weigh the ball. Pump in 5 strokes of air; weigh the ball again. Add another 5 strokes, re-weigh, and continue until the ball is properly inflated (not too mushy, not too hard). What did you notice about the ball's weight? What does this tell you about air? Write to us at www.dragonflytv.org, and tell us what you found out!

Take It Outside!

Everyone knows a heavier baseball bat sends the ball farther than a light one, right? Better find out for yourself! Set up an experiment to determine which size bat is right for you, and why. Get a variety of bats from your friends, or from your gym teacher. The bats might be as light as 18 ounces (510 grams) or as heavy as 23 ounces (650 grams). Decide whether to hit from a tee, or from a pitching machine. Have your friends help record the landing spot of ten fly balls using each bat. Calculate an average. Which bat is best for you? What about for your friend? How about an older player? Is bat weight really the most important thing, or is it something else? Write to us at **www.dragonflytv.org**, and tell us what you found out!

Student Page

303 / WIND:

How does kite shape affect the way a kite does stunts?

What's Up?

We're Danielle and Jasmine. Our kites are colorful and graceful, but they're also fierce competitors. We love to enter kite-flying contests, and we're serious about winning. Our question is: how does our kite's shape affect its performance? Which kite lets us maneuver our way to victory?

Take the DFTV Challenge!

Kites come in all kinds of shapes and designs, including Delta, Diamond, Box, Sled, and single-string or double-string varieties. With your group, decide which kite style you want to make; remember you can make different size kites of that style. Decide what to measure or observe that tells you how easy the kite is to control.
Describe your investigation idea in your notebook.
Go to www.dragonflytv.org to see how Danielle and Jasmine did their kite investigation.

Do It, Get To It

Kites, sails, and parachutes all have to catch the wind. Have a parachute design contest with your friends. Choose a material for your parachute (such as paper, cloth, or plastic), and decide how big it should be. Try different shapes, like a square, circle, or triangle. Attach your parachute to a small toy figurine with thread or fishing line. Find a safe balcony or ledge from which you can drop the parachute. Measure and record the amount of time it takes your parachute to reach the ground. Which design and materials worked best for you? Write to us at www.dragonflytv.org, and tell us what you found out!

Take It Outside!

Ever notice how some kites have tails and some don't? Diamond kites are the most familiar kite shape, and they almost always have tails. What kind of tail gives the best kite flying experience? Build or buy a diamond kite, and make several lengths of tail, using ribbon from a craft store. Attach one tail at a time, and fly the kite, paying attention to how easily it takes off, and how well it flies. What happens with a short tail? How about a long one? Can a tail be too long? What happens if you put a tail on each of the side points of the diamond, instead of just one tail on the bottom? Write to us at **www.dragonflytv.org**, and tell us what you found out!

Student Page

304 / FORENSICS:

How can I figure out who raided my sister's birthday party?

What's Up?

We're Carolyn and Kalia, and we were having a birthday party for my sister Lizzy. Before the party began, we found Lizzy's party set-up trashed; the cake was half-eaten, presents were thrown everywhere, and there was even some bright red stuff dripping off the table. We quickly shifted into detective mode, to try to solve the mystery of who ate the birthday cake. What evidence do you think tipped us off?

Take the DFTV Challenge!

So imagine yourself at a birthday party scene like Lizzy's. What sort of evidence would you collect, and how? What special tools would you need to analyze the clues? How would you identify likely suspects? Think about how to sort out misleading clues form real clues, and match the crime scene evidence to the bandit. Write down your investigation ideas in your notebook. Go to www.dragonflytv.org and see how Carolyn and Kalia analyzed evidence to nab the birthday cake bandit!

Do It, Get To It

Fingerprints have long been an important piece of evidence in solving crimes. You can learn to "lift" fingerprints, too. Get your hands a little greasy with lotion, or by handling a snack, like chips or crackers. Then touch a clean glass, mirror, or countertop. Using an artist's paintbrush, lightly dust the print with graphite powder from a pencil, or even dust from a charcoal briquette. Apply a piece of clear packing tape over the print, lift it off, and stick it onto white paper. Get your friends together and practice identifying each others prints! Write to us at www.dragonflytv.org and tell us what you found out!

Take It Outside!

One kind of forensic analysis involves splashes and splatters. Do your own splatter analysis with water balloons. Fill up some water balloons, then throw them at a dry paved surface, like a driveway or playground, from different heights and angles. Draw the splash patterns each balloon makes. Then have a friend throw a balloon without you watching. Analyze the new pattern, compare it to your reference patterns, and try to figure out how this splatter was made. Write to us at **www.dragonflytv.org** and tell us what you found out!

Student Page

305 / ENGINEERING:

How can we improve the glide of our hovercraft?

What's Up?

Who doesn't love to rise above it all? We're Rachel and Sara, and we're into engineering. We wanted to build our own hovercraft. We bought a few things from the hardware store, and grabbed stuff laying around in the garage, and made a hovercraft that we could ride! It worked well on concrete, but it didn't work very well on grass. Our question: how can we make our hovercraft glide over uneven surfaces?

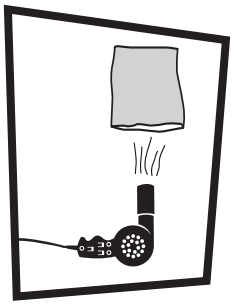
Take the DFTV Challenge!

A hovercraft uses air to lift itself slightly off the ground. If you can't build a hovercraft large enough to ride on, then try making a smaller one. Use a blow dryer, cardboard, plastic garbage bag, and a can lid, to make a miniature hovercraft. Pick a feature to vary, such as changing the surface area of the hovercraft base, or increasing/decreasing the weight of the craft. Decide what surface to test your hovercraft on. Write down your design ideas in your notebook. Go to www.dragonflytv.org to see how Rachel and Sara investigated this question.

Do It, Get To It

If you've ever played air hockey, then you've seen a kind of hovercraft: the air hockey puck! Use an air hockey table for a science investigation. Find other things around the house that might work as hovercrafts on an air hockey table. How does the amount of surface area relate to the amount of weight it can carry and still hover? Write to us at www.dragonflytv.org, and tell us what you found out!

Take It Outside!



Make your own hot air balloon, from a lightweight plastic bag, paper band, thread, cellophane tape, and paper clips. Have a thermometer handy to measure the outside air temperature. Inflate the bag with hot air from a hair dryer. (Don't use flames to heat the air for this experiment!) When it's full, release it, and try to measure how high the balloon flies, and time how long it stays in the air before returning. Do you get different results in the cool morning air, compared to the heat of the afternoon? What other changes in your balloon design give it a long-lasting flight? Write to us at **www.dragonflytv.org**, and tell us what you found out!

About the DFTV Investigations

HOCKEY

NATIONAL SCIENCE EDUCATION STANDARD

Physical Science Grades K–4:
Properties of Objects and Materials; Position and Motion of Objects

Science and Technology Grades K–4:
Understandings about Science and Technology

Tess, Alison, and Christina collected wooden hockey sticks with flex numbers of 65, 75, and 95. (These numbers indicate the force in pounds required to put a 3" bow in the shaft of the stick.) The greater the flex number, the more potential energy should be available to add to their shot speed. They each took ten slapshots at the net, using a sports radar gun to measure the puck speed. They found that their own strength was the key factor to getting the "slingshot" effect out of the stick. If they couldn't flex the stick, they couldn't take advantage of its potential energy.

Explore other sports examples where potential energy plays a part, such as tennis racket tension, diving board flex, or basketball inflation. For more details about this investigation, visit **www.dragonflytv.org.**

KITE FLYING

NATIONAL SCIENCE EDUCATION STANDARD

Earth and Space Science Grades K–4:
Objects in the Sky

Physical Science Grades 5–8:
Motions and Forces

Danielle and Jasmine flew three different Delta kites, a two-string variety used in kite ballet and stunt competition. One was wide and short, one was tall and skinny, and the third was in between. The ratio of width to height is referred to as the "aspect ratio". Danielle found that the tall and skinny kite was able to execute maneuvers requiring quick turns, but couldn't "catch air" to do delicate, hovering maneuvers. The wide and short kites couldn't execute sharp turns, but were better for gentle, sweeping movements. The shape of a kite determines how the air pushes on it, and affects its performance in stunts.

Kites are a great tool for exploration of lift and drag forces, and a fantastic way to blend engineering skills with science principles. Observing kite 'behavior' can also be an excellent way to hone students' observation skills. For more details about this investigation, visit **www.dragonflytv.org**.

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About the DFTV Investigations

FORENSICS

NATIONAL SCIENCE EDUCATION STANDARD

Science in Personal and Social Perspectives Grades K–4:
Science and Technology in Local Challenges

Physical Science Grades 5-8:
Transfer of Energy (light scattering)

Carolyn and Kalia examined fingerprint and handwriting evidence, even sequenced DNA with the help of their local high school science lab. To characterize the fiber sample, they used a standard laser pen to generate a diffraction pattern for the crime scene fiber and the hair samples from the suspects. They found that the diffraction pattern of the crime sample didn't match the human hair samples they collected, which got them thinking about non-human suspects. In combination with the other evidence and eyewitness testimony, they concluded that Lizzy tampered with her own presents, but the family dog, Sammy, crashed the party and ate the cake!

Laser diffraction is a simple technique to compare the dimensions of small things like hair thickness, or spacing of grooves in the surface of a CD. With a little algebra, you can determine an actual measurement value. For more details about this investigation, visit **www.dragonflytv.org**.

HOVERCRAFT

NATIONAL SCIENCE EDUCATION STANDARD

Science and Technology K–4:
Understanding about Science and Technology

Physical Science Grades 5–8:
Motions and Forces

Rachel and Sara built two hovercrafts to ride, one with a billowy "skirt", the other with a "tight" skirt. They ran each hovercraft through an obstacle course, and evaluated the performance of each. They found the billowy skirt gave them a better performance. To understand why, they set each hovercraft over a pile of glitter, and measured the scatter of the glitter. The billowy skirt allowed air to build up a better film of air between craft and the ground, even allowing the hovercraft to float over rough surfaces.

Work with students to help them grasp the multiple roles that air plays in the function of a hovercraft: air pressure inflates the skirt; air that leaks out of the skirt provides a near frictionless film for the craft to ride on. For more details about this investigation, visit **www.dragonflytv.org**.

DragonflyTV Themes

DragonflyTV is all about real kids, just like you, doing REAL SCIENCE!
Check your local PBS listings to tune into episodes on these great topics:

Season 1

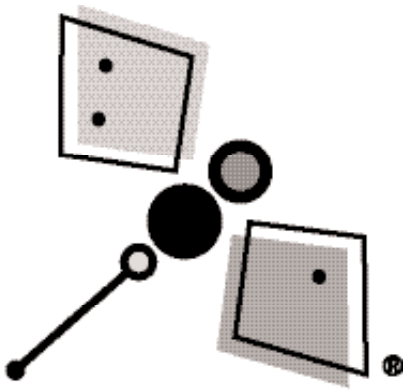
101 Investigate!
102 Wheels
103 Animal Behavior
104 Water
105 Rocks
106 Flight
107 Weather
108 Technology
109 Plants
110 Air
111 Human Behavior
112 Space
113 Human Body

Season 2

201 Investigate II
202 Structures
203 Sports Science
204 Spinning
205 Propulsion
206 Human Body
207 Sound
208 Technology
209 Ecosystems
210 Underwater
211 Mammals
212 Earth Systems

Season 3

301 Investigate III
302 Sports Science
303 Wind
304 Forensics
305 Engineering
306 Earth Systems
307 Animal Behavior
308 Speed
309 Health
310 Habitats
311 Games
312 Space/Astronomy
313 Dogs



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