Teacher's Guides

The National Science Teachers Association and science educators at Miami University of Ohio brought stories of real kids doing real science to classrooms across America with Dragonfly magazine. Originally published by the NSTA and now published by Scientific American Explorations, Dragonfly showed real kids dreaming, developing and doing their own inquiry-based investigations. The creators of Dragonfly magazine then shared this concept with Twin Cities Public Television, who brought the ideas to a whole new medium: introducing DragonflyTV!

DragonflyTV premieres on PBS stations nationwide in January 2002, and includes off-air record rights for a full year! (Check with your local PBS station for exact broadcast date and time.)

These Teacher's Guides are based on DragonflyTV investigations. Please enjoy using, modifying, and sharing these guides, which will be featured in upcoming National Science Teachers Association publications.

To learn more about DFTV and Dragonfly magazine, visit our Web site at pbskids.org/dragonflytv.

In this issue...

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

dragonflytv

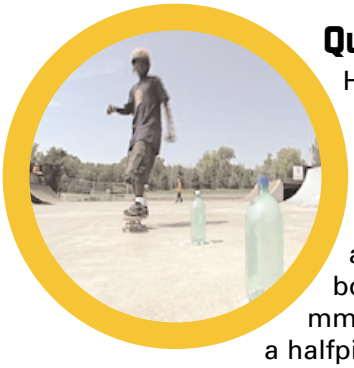
Wheels – Get Rollin'!

Episode 102

Investigations To Explore

Skateboards

Chuck and Jake spend all their spare time skateboarding, and wanted to discover more about their favorite sport.



Question

How does wheel size affect skateboard performance?

Investigation

Chuck and Jake performed speed and maneuverability tests on their boards, using 50 mm wheels and 60 mm wheels. Each boy dropped down a halfpipe, and coasted on the flat for 15 meters, recording the time. Then, they set up a slalom course of empty soda bottles, and recorded the number of bottles they knocked down.

Results

	Chuck	Jake
Coast time		
– 50 mm wheels	2.3 sec.	2.4 sec.
– 60 mm wheels	2.4 sec.	2.4 sec.
Slalom bottles knocked over		
– 50 mm wheels	2	2
– 60 mm wheels	0	3

Conclusion

Chuck and Jake concluded that wheel size was not a factor in their speed test, but it made a big difference in their maneuverability test.

Motocross

Motocross racers Tamera and Tara love the thrill of a breathtaking jump, and wanted to learn more about nailing a safe landing.

Question

How should I position my body to land the perfect jump?

Investigation

The girls tried three body positions: leaning back, leaning forward, and staying centered.

Conclusion

Tamera and Tara found that keeping their bodies centered over the bike so their weight was equally distributed gave them the best landing during the race.

Find out more: pbskids.org/dragonflytv.

Engineers: Bruce Roberts & Rick Solarez

Bruce and Rick are engineers for Harley-Davidson. Their job is to design and test new ideas for motorcycles. They use a lot of math, along with cool computer programs, to come up with the best possible motorcycle design.

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Wheels – Get Rollin'!

Episode 102

Classroom Inquiry

1) Getting Started

- How many of you skateboard? Rollerblade? Have you ever replaced your wheels, or had someone do it for you?
- What properties of a skateboard affect the rider's ability to do stunts (e.g. board size, wheel size, other)?
- If you could pick out your own skateboard from a pro shop, how would you decide what kind to buy? (Collect ideas on a chart or the blackboard.)

2) Going Deeper

- What skateboard features can we observe/measure (e.g. size, length, weight, springiness, wheel characteristics, distance between wheels)?
- Because you choose a skateboard according to how well you can ride it, what performance qualities could we measure (e.g. speed, control, jump height, maneuverability)?
- Which of those features should we select? How will we measure/observe them? How many measurements should we make? Try to select a board characteristic and match it to a performance.
- What will we do with the data we collect (e.g. tabulate, graph, compare, average)?

3) Investigate with DragonflyTV

- Watch the video and see how Chuck and Jake investigated skateboards – OR – give your students data from the video (see opposite page) and have them draw their own conclusions.
- Is it necessary to calculate a speed, or can you just use the stopwatch times? What kind of a stopwatch reading indicates a faster speed?
- What do the boys' results say about wheel size and speed, in their test?
- What does it mean that Chuck's slalom results came out differently from Jake's?

4) Investigate On Your Own

- Using Skateboard or Motocross as a model, ask your students to design their own investigations. These challenge cards for student teams may help!

Challenge Cards

1) Skateboard Geometry

The wheels of a Rollerblade form a line. The wheels of a skateboard form a rectangle. Can you imagine a skateboard where the wheels form a triangle? A circle? Make some predictions about how the position of the wheels and the distance between them affects speed and manueverablitiy.

Build and test different skateboards using identical materials and explore your predictions, changing only the distance between wheels or the position.

2) Inside Scooters

Get two or three different scooters and compare the wheel width and diameter. What are the wheels made of? What type of bearing is used? How do these differences affect the speed or smoothness of the ride? Compare two-wheeled scooters with three-wheeled scooters. Which is faster, easier to stop or steer, more stable? Why?

3) Bike Check

Compare the wheels on a mountain bike with the wheels on a racing bicycle. How are they different and why? Make predictions about why the treads are different. Does the tread affect traction? Speed? Test your ideas. OR, compare the spokes on the two kinds of wheels. Do you think the number of spokes makes any difference in how fast the wheel can spin or how stable it is? Why? Test your ideas. OR, how do the number of gears and the number of teeth on the gears affect speed and power? Gears are wheels, too!

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Water – Get Wet!
Episode 104

Investigations To Explore Waterslides

Valerie and Margie love the slippery fun of waterslides, and wanted to learn more about them.

Question

What factors make a great waterslide?

Investigation

Valerie and Margie rode two different waterslides, the "Flash Flood" and the "Salsa Twist." They found out how long each ride was, and recorded the duration of each ride several times with a stopwatch. They also used a home-made 'mazometer' to measure how wild the ride was. The mazometer was a simple maze, drawn on paper and laminated. As the girls rode the slides, they tried to draw inside the lines of the maze. The more messy their drawings were, the "wilder" the ride!

Results

	Flash Flood	Salsa Twist
Slide length	86 m	80 m
Ride time	19 sec.	20 sec.
Speed	4.5 m/s	4.0 m/s
Mazometer	neat	messy

Conclusion

They found that the Flash Flood was faster than the Salsa Twist, but the messy mazometer reading meant the Salsa Twister was wilder. That explained why they enjoyed the Salsa Twist more than Flash Flood!

Surfing

Carsten is 12 years old and has been surfing six years. He wanted to learn everything he can about surfing.

Question

Where are waves better for surfing: at a beach break, or at a reef break?

Investigation

Carsten and his friends recorded three things:

- How long his ride lasted;
- How many maneuvers he did;
- How fast he felt he was going.

Conclusion

Carsten found he got the longest rides with most maneuvers on a beach break.

Find out more: pbskids.org/dragonflytv.

Scientist: Carlos de la Rosa

Carlos studies insects living in the waters of the Kissimmee River. His research helps restore the health of this river. Carlos has been interested in insects and things that live in water since he was a young boy, growing up in Venezuela.

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Water – Get Wet!

Episode 104

Classroom Inquiry

1) Getting Started

- Have you ever been on a waterslide? What's the best slide you've ever ridden?
- Can you say what makes a good ride? How would you investigate this? (Collect ideas on a chart or the blackboard.)

2) Going Deeper

- What features of a waterslide can we measure or observe? (e.g. length, duration, speed, # of turns, types of turns, slipperiness, "wildness")?
- Which of those features should we select? How will we measure/observe them? How many measurements should we make?
- What will we do with the data we collect (e.g. tabulate, graph, compare, average)?

3) Investigate With DragonflyTV

- Watch the video and see how Margie and Valerie investigated waterslides – OR – give your students data from the video (see opposite page) and have them draw their own conclusions.
- How do you convert the stopwatch readings to speed (speed = length of slide/time)?
- What do the mazometer results tell you?
- Which property (speed or wildness) explains why Margie and Valerie like the Salsa Twist?
- What would you do differently?

4) Investigate On Your Own

- Using Waterslides or Surfing as a model, ask your students to design their own investigations. These challenge cards for student teams may help!

Challenge Cards

1) Build Your Own Mazometer

Draw a circular maze on a piece of paper and laminate it if you plan on getting it wet. For each of the different motions below, draw and test different mazometers and find the one that works best in each category:

- side-to-side motion
- up-and-down motion
- sudden jolts

Test your mazometers on a local waterslide, roller coaster, or even a bus ride.

2) Is Water Slippery?

Use a garden hose to turn a regular slide into a waterslide. Is the water slide faster, or just more fun than a dry slide?

Think of a way to measure if a wet slide is more slippery than a dry slide. If so, how much more slippery? Is running water more slippery than standing water?

3) Ocean In A Sand Box

You can explore waves by making a depression in a sandbox and lining it with a sheet of plastic. Then just pour in water. How will you create a wave?

Investigate how the length and the angle of the "beach" influences the shape of waves. What happens when you add rocks, change the water depth, or make other changes?

Tip: You can use corks or food coloring to better observe how the water moves.

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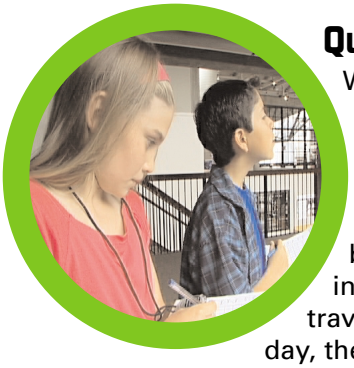
Animal Behavior
Episode 103

Investigations To Explore

Otters

Animal lovers Michelle and Josue wanted to learn more about the behavior of some amazing otters.



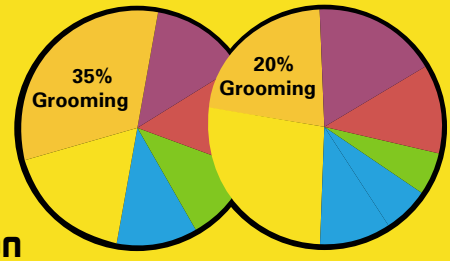
Question

Where do otters groom more…in the wild, or in captivity?

Investigation

Michelle and Josue chose six behaviors to observe: resting, playing, feeding, diving, grooming, and traveling. Three different times in the day, they recorded the number of minutes the otters spent in each activity. They compiled their results into a pie chart. They repeated the observation for otters in the wild.

Results



Conclusion

Michelle and Josue's charts indicate that the captive otters spend more time grooming than wild otters do. They speculate that this is because wild otters have to fend for themselves, and divide their time equally among the different behaviors.

Scientist: Michelle Jeffries

Michelle is an otter biologist at the Monterey Bay Aquarium. She is concerned with all aspects of otter care, including the rescue and rehabilitation of abandoned or injured otters in the wild.

Dog Intelligence

Laura and Anna wanted to explore the brain power of their dogs, Lucy and Fisher.

Question

Which dog solves problems more quickly…Lucy, a golden retriever, or Fisher, a terrier?

Investigation

The girls have their dogs try to solve four simple tests, and recorded the time each dog needed to complete the test.

Conclusion

The girls found that Lucy's size and strength gave her an advantage in certain tests, while Fisher's curiosity and small size helped him in others.

Find out more: pbskids.org/dragonflytv.

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Animal Behavior

Episode 103

Classroom Inquiry

1) Getting Started

- Ask about pets or bring one to class to get everyone talking about behavior.
- What animals do you like to watch? Why?
- What is behavior? Do sponges have behaviors? Who studies behavior? How do they study behavior?
- Think of a zoo animal, and describe different behaviors you've seen it do: eat, sleep, play, care for its young, communicate, groom, attack, etc.
- Have you ever wondered if an animal behaves differently in the wild, compared to at the zoo? What might the differences be?

2) Going Deeper

- How long would you have to watch a particular animal to know its behavior?
- Decide how to construct an animal activity log, and what should go in it.
- Once you observe an animal, what might you discover about the animal's habits? How might you make an activity log for humans?

3) Investigate with DragonflyTV

- Watch the video and see how Michelle and Josue investigated otters – OR – give your students data from the video (see opposite page) and have them draw their own conclusions.
- Michelle and Josue observed six behaviors; which one did they focus on?
- What do the pie charts say about how captive and wild otters groom? Why do you think there's a difference?
- Michelle and Josue think captive otters groom more because they don't have to spend time on finding food or other survival behaviors. What other reasons could there be?
- What would you do differently?

4) Investigate On Your Own

- Using Otters or Dog Intelligence as a model, ask your students to design their own investigations. Here are some challenge cards to give to student teams to get things rolling.

Challenge Cards

1) Human Grooming

Who grooms more: Adults, teenagers, or children? Boys or girls?

OR

Compare humans to pets. Do humans groom more than cats?

2) How Social Are They?

People say that cats are loners and dogs love people. Carry out an investigation to test if this is true.

Remember that each dog and cat has its own personality, so you will need to observe many animals to answer this question. How will you decide when dogs and cats are being sociable?

3) Approaching Squirrels

How close can you get to a squirrel? Does it matter if you are quiet or noisy? Crouching or standing up? Wearing brown or yellow? Could you get closer if you walked backwards?

Write down at least one prediction and conduct an investigation to check it out.

Tip: To help measure distance, drop a marker at your feet when a squirrel runs away. Place another marker where the squirrel was before it ran away.

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Inquiry Tips

Take the Dragonfly Q.U.E.S.T.

Question and Observe

Ouestions lead to observations, and observations lead to better questions.

Look Closer. Observe, draw, and measure such details as size, texture, and sound.

What is the Same/What's Different? Ask students to observe similarities and differences.

Revealing Patterns. When students observe events in detail, have them look for possible patterns. Can they categorize the objects they observed? For example, after rolling skateboards down a ramp, they might classify the boards by speed: fast, medium, and slow. Do all the slow boards have larger wheels? Harder wheels?

Uncover Comparative Questions

Help students move from careful observations to finding just the right question to investigate. Often the first questions your students ask are purely descriptive. Suppose someone asks, "How many creatures are under that rock?" You look and find four pillbugs. The question is answered, but it doesn't lead to any meaningful information.

Turn descriptive questions into comparative questions. A good comparative question would be: "Which type of rock has more animals under it – big rocks or small ones?" This comparative question leads to others: Do more animals live under big rocks just because of size? Or is there more moisture under big rocks? A wonderful investigation can be launched with just one simple comparative question.

Explore Predictions

Help cultivate solid reasoning behind your students' predictions. The reasoning is as important as the predictions. When asking for predictions, also ask: "Why do you think so?" Challenge them to find more information on their topic and refine their predictions. Some predictions are more testable than others. Is there enough time available to test the prediction? Do you have the right equipment?

Start Action Plan and Gather Data

Have your students create an action plan that shows each step they will take to get the information they need. Action plans help focus investigations. Students should think about what materials they need. What should be measured? How many times? For how long? Have students design a data sheet to record their findings.

Don't be surprised if your students need to change their original plan. Revising is part of every creative endeavor.

Think Hard about Findings and Share Discoveries.

Thinking hard about what it all means is an exciting process. Everyone may not agree on a single interpretation. Your students may change their minds about what the information means after talking with others. Sharing your discoveries is part of the fun. What is the most important information to share? How should it be shown? For example, should skateboard speed be shown in a sketch? A bar chart? A pie chart? A combination? Don't stop there. Be imaginative. For example, a group that investigated skateboards might hold a skateboard demonstration for their classmates and parents.

Going Further. Questions are a renewable resource!

What Makes a Great Dragonfly Inquiry?

Great inquiries arise when students trust their own questions and discover answers for themselves. As a teacher, you don't have to be an expert, all you need is a willingness to join children in the questions they ask.

If your students have great investigations, visit our Web site at pbskids.org/dragonflytv and tell us about them. Your students could be on DFTV!

For graduate-credit teacher workshops, visit www.DragonflyWorkshops.org

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