HOW TO USE THIS GUIDE

1. Duplicate the DFTV student pages (pp. 3–6), and distribute them 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 them 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, 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.

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.

306 / Earth Systems:
How do rapids affect our river ride?

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Student Page

What's Up?

We're Scotty, Kohner, Rasheed, and JB, and we're taking our first rafting trip down the American River. We know that parts of the river are calm, but other parts have some rockin' rapids with crazy names like Satan's Cesspool. We want to figure out how the river is going to push our raft around, so we can get through safely. Our question: How does the elevation change in the river relate to the difficulty of the rapids, and how should we paddle in those tough spots?

How Would You Investigate This Question?

Decide how to measure river properties such as elevation, elevation change, and flow rate. What about special features in the river, such as large boulders, or places where the river narrows or widens? How does the water flow in each of these places? Devise a way to test your ideas with a model. Describe your ideas in your notebook. Then discuss them with your teacher, or go to www.dragonflytv.org to learn how Scotty, Kohner, Rasheed, and JB did their river investigation.

Do It, Get To It

When rivers carve out a path, they tend to meander, which means that they snake back and forth. Make a river model with sand in a jelly roll pan. Lift one end of the pan and pour water slowly at the top. Watch how the water carves out a meandering river. Try the experiment several times, and even put obstacles like rocks on the tray, to see how they affect the "river's" path.

Take It Outside!

Find a stream near where you live, and determine its elevation change. Walk off a certain distance along the stream, say, 20 meters. Determine the amount the stream level drops over that distance. You may need to use stakes and a string to make a horizontal reference line, then measure how much below the reference line the stream surface drops. How does the elevation change compare between two different parts of the stream? What else do you notice about how deep the stream is there, or how quickly the water runs?

Go to www.dragonflytv.org, "**Be On DFTV**," and tell us what happened!

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SEE IT ON PBS KIDS

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About the DFTV Investigations
(for the educator)

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Educator Page

WHITEWATER RAFTING
NATIONAL SCIENCE EDUCATION STANDARD

Earth Science Grades K–4:
Changes in Earth and Sky
Earth Science Grades 5–8:
Earth's History

The four boys took a guided raft ride down the American River. They walked off 100 paces along the river bank in a calm stretch, and along a rapids. They estimated the elevation change over that stretch by comparing GPS readings at the beginning and end points with information on a topographical map. They also dropped a flotation device into the water and timed its run through that stretch of river. They found a much greater elevation change in the rapids compared to the clam area. They also looked at water flow direction around eddies, tongues, and holes (three river rapid features), to learn what forces would be acting on them as they rafted through.

A river investigation like this is difficult to set up, but look for smaller scale versions using a nearby stream or creek. For more details on this investigation, visit www.dragonflytv.org.

HORSE EARS
NATIONAL SCIENCE EDUCATION STANDARD

Life Science Grades K–4:
The Characteristics of Organisms
Life Science Grades 5–8:
Regulation and Behavior

Ting and Mallory studied the behaviors of more than a dozen horses, after Ting approached each wearing some horse ears she made. She approached the horses with no horse ears, then with ears facing forward, and finally with ears facing backward. She observed the horse's own ear position, and whether the horse was friendly or agitated. She found that the horses were generally more agitated when she wore the ears. Further, wearing them in the back position, the horses were particularly uneasy. Horses put their own ears back to symbolize aggression, and Ting's horse ears seemed to convey the same thing.

Invite your students to spend some time carefully observing animal behavior in a controlled setting, whether it's a dog, cat, gerbil, or goldfish. Talk with your students about resisting the temptation to assign human attributes to animals. For more details on this investigation, visit www.dragonflytv.org.

SPEEDSKATING
NATIONAL SCIENCE EDUCATION STANDARD

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

The four kids laid out a regulation short track turn on the rink (8 meter radius), then marked lanes at radii of 8.5, 9.5, and 10.5 meters. They each skated the three turns three times, while others recorded their time to complete the half-circle turn. Each skater reported his or her feeling of control. Their results varied, but generally they found that even though the "tight" radius is a shorter distance around the turn, skating that turn did not give them their fastest times. Moreover, they agreed it was difficult to "hold the turn', meaning, the forces on the skate blades necessary to stay in the tight radius were high, and they felt their blades might slip out at any moment. They found their best performance by skating the medium radius turn, balancing speed with control.

Circular motion can be a difficult concept for students to grasp. Give particular attention to distinguish centripetal from centrifugal forces. For more details on this investigation, visit www.dragonflytv.org.

PET THERAPY
NATIONAL SCIENCE EDUCATION STANDARD

Life Science Grades K–4:
Organisms and Their Environments
Science in Personal and Social Perspectives Grades 5–8:
Personal Health

Jeff received permission from parents of six young patients to participate in his study. Each child was facing a painful medical procedure that day. After receiving the procedure, Jeff assessed each child's pain level using a "faces" scale. Half of the patients then spent four minutes with Marley, the pet therapy dog, while the other four simply relaxed alone for four minutes. Jeff assessed their pain levels again. He found that the therapy dog patients demonstrated a greater reduction in pain than those who rested alone. Afterward, all the kids had the chance to spend time with Marley!

Jeff's project received a national award from the Discovery Channel Young Scientist Challenge. For more details on this investigation, visit www.dragonflytv.org.

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