HOW TO USE THIS GUIDE

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).

If you have a videotape of the episodes, play it to see how the DFTV scientists 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!"

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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212 / PLANET EARTH: How did these trails form?

What's Up?

We're Ari and JR, and we bike on some of the most wild rock formations in the country. It's all sandstone here in Moab, Utah, but the terrain really varies: sometimes it's rolling hills, and sometimes it's ledges and drop-offs. No two trails are quite the same, which really keeps us on our toes (or our pedals)! For our DragonflyTV investigation, we wondered why, if everything is made of sandstone, are these trails all so different? We thought we could get to the bottom of this puzzle by hopping back on our bikes and collecting data. How do you think we did it, and what did we find out?

HOW WOULD YOU INVESTIGATE THIS QUESTION?
Mountain biking takes your full concentration, so how can you collect data while you ride? What sorts of things would you look or listen for? Think about what tools you have available, such as your bike trip odometer. Also think about things you do while biking, like braking, pedaling, and changing gears. Those things might reveal something about the geology, too. Describe your investigation ideas in your notebook, and discuss it with your teacher, or go to www.dragonflytv.org to learn what Ari and JR discovered.

Do It, Get To It

In order to navigate Moab, your bike tires have to "grip" the rock. That requires friction. Do your own study of how well the rubber meets the road right in class. Get a board that can be used as a shelf, about 4 feet long and 1 foot wide (1.3 meters by 30 cm). Then get a rectangular rubber pencil eraser, or even a hockey puck. Set the puck on one end of the board, and slowly lift that end up, making a ramp. Keep lifting, until the puck first starts to slide. Measure the height or the angle of the ramp. Repeat the procedure, changing the surface of the ramp. Cover the ramp's surface with different materials such as sand paper or aluminum foil. How high do you tilt the ramp before the puck slides now? Find the surfaces that give the best, and worst, grip.

Take It Outside!

Investigate how your legs and your bike work together. You'll need a gear bike equipped with a speedometer, and a flat stretch of road or playground. Mark off a distance of about 50 meters (you can estimate it by walking 50 long paces.) Shift your bike into a low gear, one where it feels easy to pedal. Start at one end of the 50 meters, pedal up to a maximum speed of 8 miles per hour (about 13 km/h). Count the number of times your pedals went around during the 50 meters. Shift into a middle gear, and start again, counting the turns of your pedals once more. Finally, shift to a high gear and repeat the procedure on last time. What do you notice? When is it better to be in a low gear, compared to a high gear? What if you tried the tests at 12 mph (19 km/h)? What if you were pedaling up hill?

Teacher Page

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About the DFTV Investigations (for the educator)

ROVs

NATIONAL SCIENCE EDUCATION STANDARD

Science in Personal and Social Perspectives Grades K–4:
Changes in Environments
Science and Technology Grades 5–8:
Understandings about Science and Technology

The team compared the health of two parts of the reef: White Banks, which sees a lot of boat and human traffic, and Dino's Rock, which is not marked on most maps. At each location, they laid down a 50 foot (15 m) rope, with floating buoys every 5 feet (1.5 m). The rope and buoys provided a visual reference while they navigated the ROV from the boat. When they played back the videotape, they noticed more signs of damage and disease at White Banks compared to Dino's Rock. This could relate to the amount of human traffic at the sites, but other factors could also account for the damage.

Even if your students can't assemble their own ROV, it's a good exercise to get them thinking about what characteristics such a vehicle ought to have. Imagine some remote environments and have your students design "vehicles" to explore them. For more details about this investigation, visit www.dragonflytv.org.

PET HANDEDNESS

NATIONAL SCIENCE EDUCATION STANDARD

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

The girls chose three behaviors that required their cats to use their paws: 1) reaching for a treat in a clear tube; 2) batting at a dangly cat toy; 3) swiping at a dab of peanut butter on its nose. When they got the cats to cooperate, they found that a cat might use its right paw 9 out of 10 times to reach for the treat, but then use its left paw 7 out of 10 times to clean the peanut butter off its nose. They learned that it's difficult to make a strong conclusion about whether their cats were right- or left-pawed, without repeating the tests many times, and considering other factors.

Household and classroom pets make excellent subjects for scientific study. Animal studies also raise many issues about designing science investigations and paying attention to different factors. Caution your students about jumping to conclusions too quickly. For more details about this investigation, visit www.dragonflytv.org.

MOUNTAIN BIKES

NATIONAL SCIENCE EDUCATION STANDARD

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

The DFTV investigators rode their bikes along a one-mile (1.6 km) stretch of the Slick Rock Trail, and the Porcupine Rim Trail. They carried clip-on voice recorders and narrated their journeys, noting when they caught air, encountered debris, changed gears, and had to get off their bikes. When they played back their recordings, they found there were more dropoffs and rough trail debris on the Porcupine Rim trail, while Slick Rock was more hilly, with only some sand debris in the trail and fewer dropoffs. They concluded that Slick Rock's sandstone came from wind-borne sands, and Porcupine Rim's sandstone came from water-borne rocks, sand, and debris.

Encourage your students to think about how long it takes some geologic processes to occur. Also point out how a process like erosion can both build up new formations, and wear them down. For more details about this investigation, visit www.dragonflytv.org

SNAKES

NATIONAL SCIENCE EDUCATION STANDARD

Earth Science Grades K–4:
Organisms and Environments
Physical Science Grades 5–8:
Regulation and Behavior

The DFTV Scientists prepared three animal scents by putting minnows, a frog, and a dead mouse in separate jars of water. They also had a control jar of plain water. They dipped a cotton swab into each scent, and placed the swab into the snakes cage, counting the snakes tongue flicks for one minute. They found that the snakes flicked their tongues most often for the scent of their natural prey!

Discuss the difficulties in doing animal behavior investigations. Many factors must be considered in the snake study: time of day; date of last feeding. For more details about this investigation, visit www.dragonflytv.org.

Learn more about developing DragonflyTV investigations in your classroom, and earn college credit from Miami University of Ohio. Visit *www.dragonflyworkshops.org* for details.

Teacher Page

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