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Rocks – Rock On!
Episode 105

Investigations To Explore

Kayaking

River Rats Jenny, Danny and Simi brave very rough waters in their kayaks. They noticed that large boulders appear in some rapids but not others.

Question

Why are all the boulders in the challenging rapids, and not in the calm waters?

Investigation

Danny, Jenny and Simi explored four different rapids, Class 1 (easy) through Class 4 (challenging). They measured the water speed at each rapid by measuring the time it took a floating orange to travel 10 meters. Then they classified the size of rocks they saw in each rapid.

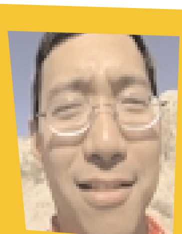
Results

Jenny, Danny and Simi found that the bigger boulders were usually found in faster waters. Here's what they found.

Rapids	Water Speed	Rock Size
Class 1	0.38 m/s	sand, gravel
Class 2	1.1 m/s	small rocks
Class 3	0.80 m/s	larger rocks
Class 4	1.7 m/s	boulders

Conclusion

They speculated that over centuries of time, fast water carried smaller rocks and sand further downstream, leaving the boulders behind. Sand and gravel are deposited in slower waters, leveling the river bed and slowing the flow even more. They were surprised that their Class 3 water speed measurement was slower than the Class 2 measurement.



Scientist: Gary Takeuchi

Gary is a paleontologist who searches for dinosaur bones in the La Brea tar pits. He loves the challenge of digging up fossils and searching for clues about ancient creatures.

Rock Climbing

Gordon and Jesse love to scale steep rock cliffs, and wondered if studying rocks would make them better climbers.

Question

How do different types of rock affect climbing?

Investigation

Gordon and Jesse climbed three different kinds of rock — igneous, metamorphic and sedimentary — and tested rock hardness, how much the rocks hurt their hands, and whether their feet slipped.

Conclusion

The boys found that rocks that provide good footholds also hurt their hands (granite and gneiss), while rocks that didn't hurt their hands also didn't provide good footholds (sandstone).

Find out more: pbskids.org/dragonflytv.

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Classroom Inquiry

1) Getting Started

- Ask if your students go canoeing or kayaking. Do they go on rivers or lakes? Or, take a trip to a local river or stream. Maybe even arrange a canoe or kayaking trip!
- What kinds of rock do they see or remember? How does water affect rocks over time?
- Ask about erosion and weathering. How long does that take? (Students living near the coast may be very aware of erosion.)
- How old are rocks? Where do rocks come from? (Not the landscape store!) Are new rocks made in nature?

2) Going Deeper

- Sort a collection of different rocks, such as river rock, used by landscapers. How many ways can you classify them? Consider size, color, hardness or other features.
- Learn to identify rock types by comparing them to pictures in a geology book.

3) Investigate with DragonflyTV

- Watch the video and see how Jenny, Danny and Simi explored the rapids of the Roaring Fork River in Colorado – OR – give your students data from the video (see opposite page) and have them draw their own conclusions.
- The three kayakers came up with a clever way to find the river speed. What did they do?
- Jenny, Danny and Simi measured the Class 3 rapids to be slower than the Class 2. What explanation did they have for that?
- They concluded that the fast water carries small rocks and gravel away. What other factors might affect the shape and speed of the river? What other experiments could you do?

4) Investigate On Your Own

- Using the Kayaking or Rock Climbing segments to start them thinking, ask your students to design their own rock investigation. Here are some challenge cards to give to student teams to get things rolling.

Challenge Cards

1) Rock Solid

How true is the saying, "Solid as a rock"? Collect different kinds of rocks and weigh them individually. Soak them in water and weigh them again. Did their weights change or stay the same? Why? Take a closer look at any rocks that gained weight. Make predictions about why they did. Test your ideas. What does your investigation tell you about how solid rocks are?

2) Invent Rock

Rocks in nature are formed in many ways. What keeps them together? Make at least three different rock recipes. Use ingredients such as clay, sand, mud, straw, Elmers glue, marbles, even cookie dough! Name your recipes and predict which one will be hardest or strongest. Why? Which ones will survive outside?

3) Watch Out for Rocks

Create a map that shows the major kinds of rock in your area. You may want to have friends bring back rocks from where they live. How many types of rock did you find? Try to relate the different kinds of rock to where they are found.

Next:

Hold a contest to see if your friends can tell the difference between natural rocks from your area and rocks that humans have made or imported. Include pieces of brick, cement or driveway gravel to test your friends.

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Inquiry Tips

The Art and Science of Investigation: On Questioning

It is true that there is no such thing as a bad question, but experienced investigators develop a knack for sifting through many questions to find just the right ones to suit their purpose. This process, which is both an art and a science, is a fundamental part of an investigation. Discuss the questions below with your students to start them thinking about the nature of inquiry and to help track down questions that will most likely lead to great discoveries.

Why should I care about this question?

If your class worked together to generate the question, chances are you have already solved the problem of relevance. Students know what they find interesting, but they may still benefit by discussing reasons why a question is significant. Such a discussion becomes more important if the students did not generate the question themselves.

Is the question too easy or too hard?

Often questions that seem easy at first lead to other questions worth investigating. Ask your students to keep probing. When faced with a question that seems too hard, ask your students to break the question into interesting pieces.

What's my best approach?

Challenge students to devise alternative strategies for addressing a question. A question about lions may best be answered by library research. Other questions may require interviews, computer research, thought experiments, direct observation, or field experiments. The best questions often challenge students to adopt multiple approaches. You might try giving students a list of questions and then have them determine the best ways to address each one.

Will this question lead anywhere?

Point out the difference between a descriptive question and a comparative question. Imagine a student who asks the descriptive question, "How many animals are under that rock?" Let's imagine she picks up the rock and finds three pillbugs and a spider. So what? It seems a dead end. But, if she asks the alternative, comparative question, "Are there more animals under big rocks than small rocks?" she opens up other questions. Does she think more animals live under big rocks just because of their size? Or is there more moisture under big rocks? Is there more protection? Do spiders fall into the same pattern as pillbugs? How could she find out? Review the questions in the DragonflyTV investigations. Are they comparative questions?

A wonderful unit could be born with just one simple comparative question. To help your students with comparative questions, have them practice moving from description to comparison.

Do we have the resources?

Some excellent questions may require more resources than students have available. Yet, constraints in time and equipment can be used to inspire students to create ingenious solutions. Often, the best investigations are completed with rulers, string, paper plates, and other simple tools. While recognizing that not everything is possible, help your students realize that more is possible than they might first think.

It would be convenient, but not very interesting, if inquiry could be defined in a simple way. It cannot because the process of investigation relates to your life inside and outside the classroom.

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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