Lesson: “If you floated down a river, where would you end up?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! When I was a kid about your age, there was this forest near where I lived. I loved to go exploring in the forest. I'd spend hours out there, and I'd always find interesting things. Like one time, I saw a baby owl up in a tree. Sometimes, I would see deer out there. There was always something new to find. One animal I really hoped I would find was a frog. I love frogs! Even to this day, they're one of my favorite animals. My dad knew this about me. And so one day in the spring, my dad said to me, "You know, Doug, it's springtime. Did you know there's a place in the forest where we can find some tadpoles, baby frogs, like these?" My dad said, "Yeah, you could catch a few, raise them here at home in a fish tank, and then release them back into the forest when they grow into frogs." I was so excited. Could we really do that? Where would we find them? So my dad took me on a hike back into the forest, but this time to a part of the forest I hadn't explored yet. I could see that up ahead of us was this water. Maybe it was a pond. Maybe it was a lake. I couldn't tell. As we got closer, my dad helped me carefully get close to the edge of the water and dip a little plastic bottle in to try to catch some of the tadpoles in it. But I accidentally dropped the bottle in the water. Oh no. Well, that's okay, I said. I think I can get it back out of the water again using a stick. But as I went to do that, that's when I realized the plastic bottle was moving. In just a few seconds, it had floated a few feet down for me. I had to run after it. Finally, I caught it, but that's when I had noticed for the first time the

bottle had moved because the water in this place was moving. I hadn't even noticed that before. I said to my dad, "Dad, why is the water doing that? It's moving." Now I already knew that in some places, the water moves. Like I'd seen waves at the ocean before. Waves are water that rise up, go down, and crash against the shore. But this movement wasn't like waves. Instead, this movement was in a line moving constantly from one place to another place further down. It wasn't crashing against the shore. It was going from here down this way. It was flowing. My dad smiled and said, "Doug, that's a river. That's what a river does. A river flows." In fact, people love to float down rivers. Sometimes in the summer when it's nice and warm, people will put inflatable tubes in, and sit on them, and then just float down the river just for fun. I thought about this some and said, "Wow, so does that mean, if you put a boat in there, you wouldn't even have to paddle?" My dad explained, "That's right. You wouldn't have to as long as you're okay going the same direction that the river flows. The river will just carry you like a train. That's what rivers do." But why? What makes the water move like this? What causes a river to flow?

EXPLORATION VIDEO 2

Why does a river flow? Why does the water move constantly from one place to another? You could probably think of a few different ideas. For example, maybe it's the wind. Like, imagine if the wind blew across the surface of the water, pushing it along. That seems like it could explain why the water moves. But if you come back and observe any river day after day, you will find out even on a calm day with no wind the river still flows. It flows all the time—constantly, wind and no wind, day and night—it doesn't matter. Well, could there be something pushing the water? You know like if you have your hand in the water, and you push on it, that makes the water move. So couldn't something be in the river pushing on it to make it flow? But if you go look, there's not anything you'd see in the water. Just looking at the river itself doesn't make it obvious

why a river flows. So let's gather more information about rivers. Maybe like if we could look at rivers from above, like with a map. This is North America. Let me show you where some of the rivers are now. Let's compare these rivers with each other, and see if rivers have anything in common. We call that looking for patterns. Just to be extra helpful, I've included arrows to show which direction the rivers flow. Have a look and discuss. Do rivers have anything in common which could help you figure out why they flow? Now here's a hint. Take this river for example. Since rivers flow from one place to another, look at where each river starts and where each river ends. Do all the rivers have anything in common? Can you find any patterns?

EXPLORATION VIDEO 3

Did you notice the pattern of where the rivers go? Well, let's see. This river right here on the map flows out towards the ocean. So does this one. And this one here. It's the largest river in North America, the Mississippi River. It flows out to this water here, the Gulf of Mexico, which is ocean water. It's salty, and it's connected to the Atlantic Ocean. And if you keep going and look at all the rivers on the map, you'll see that all major rivers flow towards an ocean. Whoa, think about that! That means that if you took an inner tube and found a big river near you to float down, even if you live nowhere near an ocean, you would eventually get to the ocean. It might take days, but you'd get there. That is so cool. Okay, so rivers end at oceans, but where did rivers start? Did you notice any pattern to where they start? Well, let's look. Here's where one starts, and here, and here. Hmm, it doesn't seem like there's any pattern. Rivers start all over the map. Hey, but wait a second. This map is flat. You know the real world isn't actually all smooth and flat like this, at least not everywhere. There are some flat, low places on Earth, like this. They're called plains. But there are also high parts, like hills and mountains. So if we create

a map that's more like the real world, a map that shows the hills and mountains on it, could that help us solve this question of what makes rivers flow?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to make a model of some land. A model is a smaller version of a real thing, and it lets you experiment and see what happens with something. Your model will show land that has high places, like mountains, and low places, like plains. Just like the real thing. If you look down at land from high above it, like this, you can see mountains look like a crumpled piece of paper. And that's what you're going to make your model from, a crumpled piece of paper. Once you've made your paper model of the land, you're going to look at it, and think about what would happen if rain were to fall on that land. Where do you think the water would go? Then, you'll make it rain on your model, using a spray bottle to make a shower. You'll watch what happens when the water falls on your model. Were you right about where the water would go? You'll find out by noticing what the water does. I'll walk you through what to do, step by step.

ACTIVITY STEP 1

If you're in a class, find a partner. You'll work together to make and test a model. If you're working alone, that will work too. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Cover your workspace with plastic. If you'll be spraying outside, you can skip this step.

ACTIVITY STEP 3

Get your supplies. Each group needs one set of these things.

ACTIVITY STEP 4

Write your names on the bottom of the handout.

ACTIVITY STEP 5

Decide with your partner who'll be the Fist and who'll be the Crumpler. If you're working alone, you can do both jobs. You have 10 seconds to decide who does which job. Ready? Go!

ACTIVITY STEP 6

Fist: make a fist. Crumpler: stack two pieces of blank paper on top of each other. This will help you make your paper landscape in the next step.

ACTIVITY STEP 7

Crumpler: crunch both pieces of paper over the fist and wrist like this. When that's done, Fist: pull your fist out and Crumpler: crumple the paper more.

ACTIVITY STEP 8

Crumpler: uncrumple the paper and line up one of the edges with the black line at the top. Fist: stick it down with two stickers and then do the same to the bottom.

ACTIVITY STEP 9

Imagine you're high above the Earth looking down. Your crumpled paper is the land below you. Talk with your partner about what your land is like. Can you see any mountains where your land goes up? Do you see any low places between the mountains? How about plains, where the land is kind of flat?

ACTIVITY STEP 10

In a minute, you're going to make it rain on your model. But before you do, where do you think the rainwater will go? Talk to your partner about what you think will happen.

ACTIVITY STEP 11

Talk and decide where the highest places on your model are. Look for places where a crinkle or fold in the paper sticks up higher than the rest, like these folds. Fist: mark these places with thick lines, like this. Crumpler: don't worry, you'll get a turn later.

ACTIVITY STEP 12

Crumpler: use the marker to trace over each line and make it darker. Use a lot of ink. The ink in these lines will color your rainwater, so you can see where it flows.

ACTIVITY STEP 13

In a minute, you're going to spray your model. But first, put your model on your table with a few other models if you're in a class so that you can all spray them in the same place.

ACTIVITY STEP 14

It's time to make it rain. Give your model five sprays. No more than five. Then stop and watch while other people spray theirs. After you wait at least one minute, spray it five more times. Your model may need a few rain showers before the water starts to flow. By waiting between showers, you give the water time to pick up more ink.

ACTIVITY STEP 15

Discuss.

ACTIVITY STEP 16

Discuss—look at this map again. If we put more detail on the map, what do you think you'd find at the start of every river? Where do rivers start? When you're done discussing, advance the slide to watch the final video.

WRAP-UP VIDEO

Now that you've had a chance to test what happens to water on a crumpled piece of paper, you've seen that water flows from high places to low places. Earlier, we saw from looking at a map that rivers flow out towards the ocean. That's where rivers end, but we couldn't make sense of whether there was any pattern to where rivers start. This map doesn't show any mountains or hills on it though, does it? So what if we label mountains and hills on this map in the places where there are actually mountains? Well, let's do that. In North America, there are mountains here. These are called the Rocky Mountains. And over here, there are more mountains. These

are called the Appalachian Mountains. And up here, there's a hilly spot. So look at that. You see all these hills and mountains now? Wow, when you look at that, now all of a sudden we can see a pattern to where rivers start. You can see that just like in the model you made, real rivers start at high places, like mountains and hills. And they flow downhill from there to low places. The low places on Earth are the oceans. The reason that rivers flow is because water falls on the land, like when it rains. That water flows from high places, like the mountains, downhill to low places, like the oceans. Rivers are just water that's flowing downhill. Where are your nearest rivers? Use a map to figure out where they start and where they go. Figure out if you were to get in a boat, or a raft, and float down your nearest river, which ocean would you end up at? Let me give you an example. Where I grew up, there wasn't a big river nearby, but there was that small river. Remember where I caught those tadpoles? Now, we call a small river a stream or a creek. When I looked at a map, I saw that my stream starts at a hill on one side of town. See, rivers and streams always start in high places, and flow down, not into the ocean, but into a bigger river called the Fox River, which also flows into another river, a bigger, longer river called the Mississippi River. And if you followed that river all the way down, you see, it flows into the ocean. So, find out where your nearby stream or river flows. If you live in the United States, there's even a website that you can use to help you figure it out. We've linked to it in the Extras. It doesn't show hills or mountains on this map, but at least you can find out which ocean your rivers flow to. Have fun and stay curious!