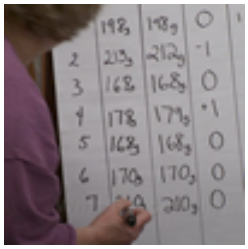
Talk Science

Professional Development



Transcript for Grade 5 Classroom Case: The Role of Data Discussions

Notes

Discussing data can be one of the most exciting and interesting parts of a science lesson — and perhaps the most important. There's a lot to learn about data and it can't all be learned at once, so it is important to help students focus in on dimensions of the data set that are most relevant to the investigation (for example, data discrepancies). Encourage students to keep the emphasis on ideas, thinking, and reasoning from the data — not on "right" answers.

Clip 1: What happens in a data discussion?

Data discussions take place after students collect data. These discussions have several purposes

- Students connect their data to the investigation question.
- They have a chance to grapple with the inevitable complexities of data.
- They practice making claims that they back up by evidence drawn from the data.

Data displays aren't always the same. In these discussions, students learn to work with annotated drawings, tables full of numbers, graphs, Venn diagrams, lists, number lines, and other representations.

Despite a variety of representations, and inconsistencies or surprises in the data, there are some key components of every data discussion.

- What question are we trying to answer with our data?
- What information do we have to work with (in our table, graph, or drawing)?
- Are there discrepancies or puzzling data that we need to clear up?
- What's the pattern or shape of our class data?
- Based on the data, what claims can we support and what's the evidence?

In this classroom case, students are learning about transformations of matter. The investigation question is *What happens to the weight and volume of water when it freezes*?

Students have weighed a water sample in a closed container and recorded the volume by marking the water level on side of the vial. The containers of water have spent the night in a freezer.

The teacher, Candace, has prepared a data table that will include numerical data (weight in grams) and descriptive data (was the volume the same, more, or less after the water froze). Candace has added a column called "change" to simplify the task of comparing

the weight of water before and after it freezes. If there are variations in the data, Candace plans to ask the class to discuss how they might explain or deal with any variation in the data.

Finally, she will ask students to formulate claims about changes in weight and volume when water freezes and point to the data they think provide supporting evidence.

But before they weigh their frozen water samples and observe the volume of the ice, students pause to predict, to think about what their data might look like before they actually collect it and why they think so. They record their predictions in writing so they can compare these initial ideas later with actual results. Unexpected results are often the surprises that raise questions and motivate students' to think and reason more deeply about an investigation.

Clip 2: Predicting sets the stage for a data discussion

Predicting requires that students take a position – based on my prior experience, this is what I think will happen and here's my reasoning. Taking a stance inevitably increases students' awareness of their own ideas and curiosity about the data they will collect. As you listen to students' predictions, remember that children initially think that when something freezes or melts, its weight should change as well. Generally, they expect that *harder things are heavier*, so they think that ice should be heavier than water. In this case, one student reasons that matter is added to the frozen water.

Text on screen
Predicting change in weight

Teacher: Can somebody read the question to me today? Tyrec, want to read the question?

Tyrec: What happens to weight and volume when water freezes?

Keanny: I think that the weight will increase because we put it in the freezer and it's adding ice to it.

Teacher: So It's adding ice. [pause] Can you say a little more?

Keanny: Because when we put it into the freezer the that … from the ice, from the ice in the coldness, some of the ice gets in the water.

Teacher: So it's added into the water, so water stays there and then ice is added into the water?

Keanny: Yes.

Teacher: How about Gabe?

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Gabe: The weight will increase because solids are more weight than liquids because ice is a solid and water is a liquid so when it's frozen it will be a solid and it's going to have more weight.

Teacher: Ok, Blerta, what did you write?

Blerta: I wrote that I predict that weight will stay the same because the water and ice are the same weight just in a different shape.

Dahlia: I agree with what Blerta said.

Teacher: Really? Can you explain why? Can you explain your thinking?

Dahlia: Because like she said that it will be the same weight. I think that it will because you're not adding anything and you're not taking anything away, so it's going to be the same weight.

Text
Predicting change in volume

Teacher: That's weight. Let's talk about volume; who wants to share their thinking on volume?

Zayla: I think the volume will be the same because you're not adding or taking away from the bottle

Madeny: I agree with that.

Teacher: You do? Why?

Madeny: Because it's just like she said, you're not adding or taking away. The water is just freezing and it will stay the same size, just frozen.

Keylan: Miss Chick, I respectfully disagree.

Teacher: OK, Why?

Keylan: Because many times I was filling up my water bottle and then I left it to freeze overnight and then when I opened it, well, when I opened the freezer it, the water, it was frozen and it like went down the side of the bottle and the cap popped off.

Blerta: I think the volume will change because the water, which will turn into ice will probably change volume, but keep its weight.

Teacher: Why?

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Blerta: Because water and ice have two different shapes. Water takes the shape of a container. It takes that shape. And ice is a cube.

Teacher: Ice is always a cube?

Blerta: No, it can be other shapes too, like something like pointy or something.

Text on final screen
Predictions are based on students' experience and initial ideas

These initial ideas will either be supported by data or will need to be modified

Clip 3: Revisiting Condensation

In this classroom students have learned about condensation in the 2-bottle system investigation. Even so, they will need to observe and discuss condensation again and in other contexts before they really understand – or believe – that invisible water vapor particles in the air, in contact with a cold surface, are the source of condensation.

Teacher: We've got our bottles back from the freezer, the water we froze from yesterday and what we're going to do is we're going to take a look at the volume and we're going to do what to them?

All: Weigh them

Teacher: Weigh them and then we're going to put this data in our tables here. Now, there's one thing that's important to do and it actually has something to do with what you started to bring up which is condensation. There is condensation on the outside of the bottle Where does that come from?

Student: From the ice

Teacher: So, the ice is leaking through the bottle?

Student: No

Teacher: Where's the condensation on the outside of the bottle coming from Nathaniel?

Nathaniel: When there's ice in the bottle it kind of like draws in cold …

Student: Air

Nathaniel: Yeah, air or water vapor to the outside of the bottle.

Teacher: OK. The water vapor is coming from where?

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Nathaniel: In the air

Teacher: In the air and it's been drawn to the outside, so that's not … the water on the outside is not the water inside the bottle. We all agreed on that that the water inside is going to stay inside, but so this is extra water being drawn in from the … water vapor being drawn in from the air outside and you're going to need to wipe this off before you weigh it.

Text on final screen
Understanding of scientific ideas develops over time with support from multiple experiences and opportunities for verbalizing ideas

Clip 4: Variation in the data and making claims

Text
Data discussions focus on variations or puzzling data.
While there was very little variation in this case, Candace ensures students address it and propose a reasonable explanation.

Teacher: So, what happened to the weight? There's a question up here. What happened to our weight? Look at the chart. You can read the question up there, but you should be looking at the data here, okay, so you should be looking at the data here.

Makayla: Most of them were they had no changes, but some of them did have a slight change.

Teacher: A slight change. Anybody else?

Ana-Marie: I think most, yeah, most people their weight didn't change.

Teacher: Anything else? Anybody want to comment on that little difference that we had here in Groups 2 and Group 4?

Blerta: May I say something Ms. Chick?

Teacher: Yes, you may Blerta.

Blerta: Remember the scale is inaccurate by only a half of a gram?

Teacher: It's inaccurate to only a half a gram. What was happening with yours?

Blerta: It kept changing from 178 to 179.

Teacher: We know that it could be the inaccuracy of the scale. We've had this problem before haven't we? Yours was going back and forth a little bit too?

[the class comments among themselves]

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Teacher: Can someone look up at our chart, look at the data chart and make a claim about what happens to the weight when water freezes?

Keylan: Sometimes the weight doesn't change and it just stays the same.

Teacher: Sometimes?

Keylan: It was most of the time. Miss Chick, our scale was going back and forth then we wiped off some condensation and then it stayed at 170.

Teacher: You found a way maybe to make it more accurate. Somebody else like to use the data to make a claim about what happens when ice freezes, when water freezes and turns to ice. Sorry about that. When ice freezes, it's already frozen.

Nathaniel: When water freezes and turns into ice the weight isn't affected much and there's not much change in the weight.

Teacher: What's your evidence?

Nathaniel: Because sometimes there was a difference by one but most of the time the weight stayed the same.

Teacher: OK. So let's take a look at that. We can now make a claim about the volume when water freezes? Who can make a claim about the volume and use the evidence on the data chart to support their claim? Zaria.

Zaria: The volume of the ice when it freezes … the water when it freezes increased for all the groups.

Teacher: For all the groups. This seems very, very clear. Who else can tell me in their own words and make a claim and support it with evidence from the data chart. Do you want to Gabriel?

Gabe: The volume increased.

Teacher: What told you that?

Gabe: That when we went to look at the bottle, the mark was below the level

Teacher: Right. The mark that we put on yesterday was below today's level from where the ice actually was.

Text on final screen
Using evidence from the data to make claims is an important scientific practice that requires support and repetition.

Notes

Clip 5: Comparing results with predictions

Text on screen
Students' predictions about weight are not supported by the data. As they discuss these surprising findings, students' ideas begin to change.

Teacher: Can we now turn to page … and remind me I've already forgotten the number again, can you believe that? Thirty-one. To Page 31 and take a look at your reflection because what we asked you to do is to reflect on what you had said as your prediction and then what you actually found out. Somebody want to share what they wrote?

Makayla: When we found out that the weight stayed the same I was surprised because the ice passed the line and when I saw it I thought that the weight would increase, but when I weighed it was the exact same thing, the exact same thing as the first time … the first day we weighed it.

Keylan: I thought the weight was going to be different, but it was the same. The volume was very different

Teacher: So does this make sense that the weight didn't change?

Tyrec: Yes, that the weight didn't change…

Teacher: Tell me why.

Tyrec: It doesn't make sense, kind of, to me.

Teacher: Why?

Tyrec: Because ice is like hard and it's a solid and ice should be strong.

Teacher: That's a property of ice. It is a solid. It's hard and strong.

Keanny: Ice is just like water except it's a solid right now, but when it melts it's water. It's a liquid.

Teacher: You're saying that it does make sense or it doesn't make sense?

Keanny: It does makes sense.

Teacher: It does make sense to you.

Madeny: It didn't make sense because even the question why does the bottle volume increase but the weight stayed the same?

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Teacher: That's a good comment. Madeny wants to know why" Why did the volume - everybody's volume - increase while the weight stayed the same pretty much?

Makayla: It makes sense to me now because you're not adding anything or taking anything out of it, of the bottle.

Text on final screen
Surprises in the data are often catalysts for learning.
Some productive data discussion questions are
"Did anything surprise you?"
"Do these results make sense to you?"

Notes