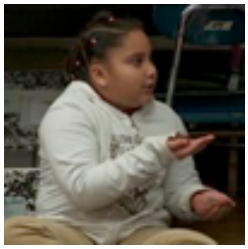
Talk Science

Professional Development



Transcript for Grade 4 Classroom Case: The Role of Explanation Discussions

1. What is an Explanation Discussion?

Talk Science focuses on 4 kinds of discussions. Classroom Case 4 is about Explanation Discussions. An Explanation Discussion takes place after students have collected and analyzed data and they are ready to use the data to draw conclusions.

Students return to the investigation question and use evidence drawn from the data to make claims. In their discussion, they state their claim and explain how they think the data justify or support the claim. As they discuss and debate ideas, the group might agree that there is evidence to warrant a claim, or cite additional evidence for the claim, or someone might identify contradictory evidence, or come up with a different claim altogether.

Explanation discussions also focus on the scientific phenomenon that explains the findings. In the case of displacement of water, for example, the explanation for the change in the water level is a familiar one – two objects can't occupy the same space at the same time. However, it is challenging for students to combine this idea with their surprising finding that it's the volume, not weight, that determines how much water will be displaced. Through talk, students connect these two explanations: two objects can't occupy the same space at the same time and the object that makes the water level rise the most is the one that takes up the most space – that is, the one with the greatest volume.

In the next clip of this classroom case, you will listen to students explain their initial ideas about what happens to the water level when an object such as a rock is placed in a container of water and what factor – weight or volume – determines how high the water level will rise. In Clip 3 you will see students collecting data to answer the question Which factor, weight or volume, determines how high the water level will rise? In Clip 4 the explanation discussion begins with students making claims and describing the supporting evidence from their data. While almost everyone predicted that weight determines how much the water level would rise, you will hear students claim that volume is the determining factor and explain the supporting evidence from their data. In clip 5, Aadina turns the discussion to an explanation of the displacement phenomenon itself and she introduces the term "displacement." The principle that two objects can't occupy the same space at the same time allows us reason that the more space an object takes up, the greater the volume of water it pushes aside as it sinks in the water, regardless of the weight of the object.

Notes

2. Predicting and explaining

Notes

What do you predict will happen when a rock is placed in water? Why?

Teacher: I've got two containers of water here and I'm wondering what's going to happen if I take a rock and I put it inside this container. What would happen if I took a rock or any object and just plopped it into my container of water? What do you predict would happen? What do you predict would happen Julisa?

Julisa: I think the water would go up, I think the water would go up.

Teacher: Okay, why?

Julisa: Because you threw the rock in there and the rock is going to make the water go up.

Teacher: Why is the rock going to make the water go up?

John: If you put a little rock, like there, it'll still stay the same but if you put a big rock in there it'll rise up a little bit.

Teacher: So you think a small rock or a small object won't cause the water level to change but a big rock will?

John: Yes.

Teacher: Ok. Nikia, I see you're giving a thumbs up, can you explain why you're giving me a thumbs up?

Nikia: Because I agree with John because it depends on the weight. If the weight is heavy then the water will rise and if the weight is not heavy then it won't rise.

Teacher: Oh, other thoughts. What do you think will happen to that water level if I have a rock and I place it in there? I've heard two very different ideas, someone saying that nothing will happen to the water level, I heard someone say the water level will rise. I even heard a third idea actually which was John saying that a big object will make the water level rise but a small object won't.

Dahlia: I think that …

Teacher: Speak loud and clear.

Dahlia: I think that if you put a heavy rock in the water I think that it will rise because when, it's kind of like when you have a like a cup of water and then when you put something heavy in it or if you put your hand in it then the water will rise, and when you put something heavy down on it then it will press on it and then it will rise a little bit because you're forcing the -- you're forcing, pushing it in there.

Jordan: I think that if you put a rock in there the volume would change.

Teacher: The volume of what would change?

Jordan: The volume of the water. Oh, no, it's the – well the water is not increasing because when you put it rock in the water it makes, it puts weight onto the water and if you put -- even if you take it out, the water is going to stay at that level where it is right now.

Teacher: If I put this rock into my container is the amount of water changing?

Tiffany: No.

Teacher: Why?

Tiffany: Because you're not taking away water and you're not adding water.

Teacher: Could you say that a little louder for everyone to hear. That's a really interesting idea.

Tiffany: Because you're not changing, you're not changing the amount of water. You're not taking some water, you're not pouring some water.

Text on Screen
The teacher places two rocks of different sizes and weights into equal volumes of water – to establish for everyone that the water level does rise, in both cases.

Teacher: [I want to] make sure I can get every drop of that rock. And I heard some people get exited. Why are we so exited? What happened? What happened? Esther?

Esther: The water -- the level went up.

Teacher: The water level went up. Can we all see that?

Children: Yes.

Teacher: So what I'm going to do is I'm actually going to measure, well not measure, I'm sorry. I mean mark the new water level. So I can see very clearly about how high that water level rose

Student: I don't get it, how did the water level go up?

Teacher: Well you know what that's what we're going to be figuring out today is what caused that water level to rise.

Notes

Text on Screen
What causes the water level to rise, weight or volume?

Aadina describes the procedure the class will use to test their predictions.

Teacher: So here we have two objects that have the same exact volume but different weights. So we're going to see what happens when we take those two objects and we place them in separate cups because they have the same volume, they're taking up the same amount of space but they weigh very differently. So who thinks that the heavier cube is going to make the water level rise even more than the light cube? Who thinks the light cube will make the water level rise more than the heavy cube? Anyone think they'll just rise the same amount? Okay, so we have a couple of different ideas but we're going to test that out.

Text on Screen
What causes the water to rise, weight or volume?

Teacher: We're also going to explore this material called Plasticene which as we can tell, does it have the exact same volume as these other two cubes?

Children: No.

Teacher: No, what do you notice about the volume?

Child: It's bigger.

Teacher: It's a little bit bigger. It's a little greater, a little bit. But what you're going to see is that the aluminum cube and the Plasticene cube, even though their volumes are different – they're taking up a different amount of space – there is something that is the same about them and that is that they weigh the same.

Text on Screen
What causes the water to rise, weight or volume?

Text on final screen
Students believe that weight is the factor that determines how high the water level will rise. This idea is testable.

Notes

3. Collecting Data

Notes

Text on screen

Students compare the amount of water displaced by

(a) two cubes with equal volumes but very different weights (44g and 146g)

(b) two cubes with equal weights and different volumes (16cc and 33cc)

Text on final screen

Collecting Data

- Students collect data to test their predictions
- Students' shared first-hand experiences anchor their discussions and contribute to classroom equity.

4. Explaining claims and evidence

Text on Screen

A claim answers the investigation question.

Data from observations or experiments provide evidence.

Teacher: I want us to take a few minutes now to share what it is that we discovered. So was it weight or was it volume that caused the water level to rise? What do you think? What do you think, Jasmine? What did you think?

Jasmine: I thought it was the weight when we did the ummm …

Teacher: When you did the experiments.

Jasmine: We saw that it was the volume that caused the water level to rise.

Teacher: A lot of us thought it was weight. Who went ahead and changed their mind like Jasmine said, "Wait a minute. It appears to be volume?" Who thinks they can explain why your thinking changed, what was your proof that, you know that, it actually wasn't weight? Who can prove that for me? Esther, what's our proof?

Esther: Because the volumes, the first ones (the copper cube and the aluminum cube) the volumes were the same and then we put them in the water, the water levels were the same.

Text on Screen

Claim: Volumes causes the water level to rise

Evidence [image]

Notes

Teacher: Well, what happened when we threw in the Plasticene in the mix? What happened with the Plasticene? How did that play into effect here?

Nikia: I think it's the volume because the clay is bigger than the copper and the aluminum too. That the weight [of the clay] was less than the copper in the cube.

Text on Screen

Claim: Volume causes the water level to rise
Evidence: [image]

Text on final screen

Explaining Claims and Evidence

- With their data in hand, students make claims that answer the investigation question.
- They explain how their observations or data from experiments support their claims.
- They evidence either confirms their initial ideas or challenges them to revise their thinking.

5. Using scientific ideas

When students understand water displacement, they can explain why it's volume, not weight, that causes the water level to rise.

Teacher: OK, you're telling me what happened when you did the investigation, but who can explain why? What if I was using different materials? What if I didn't have an aluminum cube and a copper cube and a Plasticene cube? What if I used two different objects that had different volumes? Well, what is it about volume that makes the water level rise? Why is that even a factor?

Dahlia: It's actually volume is saying that it's how much space the object is taking up so it makes the water level go rise up or stay the same depending on how much space it takes up.

Teacher: OK. Dahlia just brought up something really interesting. She reminded us that volume talks about how much space something takes up. Can two things take up the same amount of space at the exact same time?

All: No

Teacher: What's happening to the water when we put the object in there? Kyle.

Kyle: Because, ummm, like …..

Teacher: What's happening to the water?

Kyle: The water is moving out of the way so the material can get there.

Text on Screen
Aadina introduces the scientific term "displacement" and asks students to use their own words to describe it.

Teacher: When I place that cube of any material in there, well that water had no choice but to move out of the way so that that cube can move into its space. We call that displacement. Can everyone repeat that?
We call that water …

All: Displacement

Teacher: So, we say that the water is being displaced meaning it's getting moved out of it place and moved to a new place.
Can anyone think that they can try and explain that idea of water displacement? Someone I haven't heard too much from. I'm hearing a lot from the same friends. Who thinks they can kind of explain that idea? What's happening with water displacement? Zaria, what do you think?

Zaria: the cubes move …

Teacher: Nice and loud, Zaria

Zaria: The cube's pushing the water out of its way.

Teacher: So what is happening to the water?

Zaria: It moved up.

Teacher: It had to move up. Anyone else want to try to explain that?

Jaden: The cube is acting like there's more space and the water has to go up because it's like, it's like in a one way space.

Teacher: Ok. So it's like a one-way space meaning only one thing can be there at a time. So if that water is there and a cubes comes walking in, that cube's telling the water …

All: Move.

Teacher: Move out of my way and the water has no place to go but …

All: Up.

Notes

Teacher: Do you want to add something to that?

Jordan: Displacement is like when an object goes into the water and the water has to move up because, because there's only one thing that could fit inside there.

Notes