"We can't really talk about the whys of magnetism now"

Colleen Gillespie, University of Maryland at College Park

Before the state assessment, Ms. J felt pressure to prepare her students for the test at the expense of inquiry. After the assessment, Ms. J was able to engage her students in 7-day inquiry unit only *because* she felt freed from the usual curriculum "supports"

The Maryland State Assessment (MSA) in science is designed to support sophisticated scientific practices:

"The science State Curriculum communicates a definition of science… as a body of knowledge developed through the process of investigating combined with thoughtful reflections which are guided by critical thinking skills." *–Mary Thurlow, Science Coordinator for Maryland State Department of Education (MSDE)*

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Before the state test, Ms. J framed science class in two competing ways: sometimes it is about pursuing student ideas, and sometimes it is about test preparation

EXAMPLE 1: Ms. J explicitly frames class as NOT being about mechanistic reasoning.

Ms. J: Where have we used the word force before in science?
Students: Wind! Hurricanes! Tornadoes! Erosion! Earthquakes! Gravity!
Ms. J: Now I want to go back to Isaac's question, "can magnets still work underwater?" … 2 things I want you to think about. First is what the answer is, yes or no, and the second is not so much why it's happening, ***because we can't really talk about the whys of magnetism now***, but we'll come back to it, but also, I want you to think about why does that question fit in with a discussion of forces.

EXAMPLE 2: Ms. J attends and responds to a student's mechanistic reasoning without focusing on forces.

Kayla: it probably won't work in the water because I think water's kind of stronger than air because air we can kind of just walk around and stuff
Ms. J: So air seems like something we can just push out of the way more
Kayla: It's like when you swim, it's hard for your, the force of your arm to push the water, so say if you put 2 magnets, the same thing with your arms

EXAMPLE 3: Ms. J redirects the conversation to the curricular objective, and the students stop reasoning and start playing "guess the answer."

Ms. J: We're just about out of time so we're unfortunately going to have to leave this lingering until tomorrow… now, the other question I want you to think about is what on earth does all of this have to do with forces?
Josh: Because the gravitational pull
Ms. J: Because of gravity? You think gravity is what causes the magnets to go together?
Students: No! Maybe some!
Ms. J: Um, Christina?
Christina: We use magnets for forces because isn't magnetism, like it uses a force.

COMPETING FRAMES
Science class *should* be about pursuing students' ideas, but it *also has to* be about test preparation in the week before the test.

So I think we'll come back and do the water stuff after the MSA… I don't think I want to go into a full-fledged discussion about WHY it's happening yet, which kind of bothers me, because I've gotta go over these forces, that's what's driving me nuts right now… I don't feel like I have enough time to do [inquiry]. I hate to feel like 'I've gotta get this stuff covered before the test!' but I also… I don't want them to see something on the test that we've never even talked about. So I feel like I have to… cram it in.

After the state test, Ms. J framed science class as being about pursuing student ideas in service of inquiry and mechanistic reasoning.

EXAMPLE 1: Ms. J adjusts her demonstration based on students' ideas. The class has determined magnets stop attracting at the same distance through water and air (4 inches). Now they're testing wood, and Ms. J gets out a sawed-off piece of a tree. Nathan voices a concern:

Nathan: How do you know that won't be too thick?
Ms. J: Well, that's a good question, um, so why would the thickness be a problem, Nathan?
Nathan: Um, like Marquez just said the thing about 4 inches, the magnets stopped [in air], and those are the exact same magnets, so that's like 5 inches or something, so they probably won't work
Ms. J: So… you're saying it may not be a problem with the wood, it may be a problem just that at a certain point the magnets quit attracting each other… so Nathan is voicing that complaint, um, unfortunately I don't think I have a thinner piece of wood.
Student: Use the other side
Ms. J: Um, yeah I can try the smaller side, let's see what happens.

Ms. J attends to the students' ideas about the proposed experiment and makes in-the-moment adjustments in service of their mechanistic reasoning.

EXAMPLE 2: Ms. J uses Malik's idea to plan the next day's lesson. The class saw that the magnets didn't attract through the wood. Kyle proposed that maybe magnetism works through liquids and gasses but not solids. Malik has an idea:

Malik: I have a comment about Kyle's idea. What if we freeze water and try to see if that works.
Ms. J: Ahhhhh, that's an interesting idea… Did you hear what Malik said? … Now I don't happen to have any ice with me today, but, I will get it… I can bring ice tomorrow, so we may have to sneak a little science in tomorrow before social studies. Okay, so… what question would that help us sort of sort out, Malik?
Malik: Well because he says it won't work through solids, but if it works through water, then you can just turn water into a solid and see if that would work cause it's still the same substance

Ms. J recognizes that Malik's proposed experiment could further their mechanistic reasoning about magnets. She brings in ice the next day and they test and discuss ice for 20 minutes.

EXAMPLE 3: Ms. J changes the direction of the lesson after Kayla's suggestion. The class has spent 20 minutes testing testing and talking about ice. Kayla makes a suggestion, in an annoyed tone:

Kayla: Um, can we go onto the wood now, because I get what we're all saying about this, why (inaudible) and whatever, but ice is kind of different.
Ms. J: Okay… Lets put the the whole ice, solid vs. liquid thing on ice for a while… Let's go back to our question about the wood, because we still have questions about wood

Ms. J attends to Kayla's bid to switch the topic of conversation which helps sustain the productive inquiry

INQUIRY FRAME
Science class is about pursuing students' ideas in service of inquiry and mechanistic reasoning.

Yesterday we made a list of all the questions we really wanted to know before science is out, because we've got these six weeks [post-MSA] and we're really just going to go and do the stuff the kids have talked about… it's just so much a better feeling as a teacher to not be feeling like I'm the one up here who's the wizard giving the answers but instead I'm part of the process… [The other 5th grade science teacher] teaches pretty much out of the book with worksheets and activities… Her kids are probably doing better on the [MSA] than mine are, but I don't care! I don't care and I love it!.

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