



Science Modeling Talks

Episode 79 - Proportional Reasoning, Modeling Tips and the AMTA “Coffee Hour”

Guest: Janelle Hollingshead

Mark Royce (01:12):

Hi, Janelle. How are you today?

Janelle Hollingshead (01:15):

I'm good.

Mark Royce (01:16):

That's great. Now, you're in Wisconsin?

Janelle Hollingshead (01:20):

Yep.

Mark Royce (01:20):

And what's the weather like back there?

Janelle Hollingshead (01:23):

It's extremely snowy.

Mark Royce (01:26):

Oh, extremely.

Janelle Hollingshead (01:29):

Yeah. Yeah. We recently had a snowstorm that piled... It's the second most snow in at least Sturgeon Bay's history. It took me and my husband two days to shovel out our car. And there's plenty of snow drifts that are way above my height, but on a walking, on a normal sidewalk, the drifts, to get to the sidewalk, are about up to my shoulders on both sides.

Mark Royce (02:04):

Oh my gosh, <laugh>. Well, I'm sure glad you could find time and a place to connect with me today. I'm looking forward to our conversation. So I'm gonna start out, I just wanna find out and let you share how you first found out about modeling. What led you to the modeling world and got you involved with it.

Janelle Hollingshead (02:28):

I went to this ChemED conference, and Gary Abud was the speaker, and I don't remember what led me to that conference, to the workshop, really. But he talked about how he could say, sit to his dog in three different languag-

es. Spanish, I think it was Arabic, and English. And his dog always sat, but that didn't mean that his dog understood all three languages. And that our math is spoken in a way that's not helpful to understanding the math as far as fractions are concerned. So he started to talk about these "for every" statements. Like, so if you're talking about 60 miles per hour, it's not obvious what the word "per" means. So a lot of students can't answer in two hours, how far do you go? But other countries, they say a whole sentence, which would be like, for every one hour, I travel 60 miles. And when you say that sentence, all of a sudden it makes total sense. And it just, it changed how I saw everything. And I all of a sudden didn't want my students to get the right answer without knowing why, and was pretty amazing that all of a sudden with this one workshop, I understood so much more than I had before. So that was, yeah, that was sort of a brand new look into a different way of possibly doing things.

Mark Royce (04:12):

Yeah. Cool. So did he then talk about modeling workshops and that kind of stuff and that's what got you going, or?

Janelle Hollingshead (04:21):

I think so. So I was in the workshop with Phil. Phil Culcasi was also in the workshop. He sort of left one of the workshops and I didn't know him too well, and I was like, Hey, Phil, what's, what's up? And his face was kind of like, like white, like, like, and I was like, what's, you know, how are you doing? And he, he was just kinda like, I have to change everything <laugh>. And I was like, oh, okay. So, he was connected to, I think I forget the name of the physics person at his school that had been doing modeling for a long time, but he understood that this was connected to modeling. And I ended up going to his first modeling workshop that he held about chemistry, that following summer.

Mark Royce (05:05):

So Phil Culcasi was the first workshop that you went to?

Janelle Hollingshead (05:11):

Yeah. Mm-hmm

Mark Royce (05:12):

<affirmative>. Okay. Yeah. Cool. Yeah. So tell me how modeling has really changed or influenced your career, your involvement with modeling.

Janelle Hollingshead (05:24):

So I went to that workshop, and I got really excited about getting students to learn how to be scientists instead of learning about science and about how people solved science problems. And I knew at my school that there was not gonna be a shift to modeling. And so after about three years of doing a little bit of whiteboarding here and there, I got really sort of depressed professionally and was kind of thinking about quitting, because I just knew that I didn't, I didn't wanna do things the old way anymore, and I couldn't, couldn't, yeah. I just, I just knew I couldn't continue on. I didn't believe in the education that I was teaching anymore, I think is the thing. For a long time before I started modeling, I thought if I just learned more and more demos that were exciting or more games that I could have the kids play, that I would get that education, like the feeling that what I was doing and getting up to do every morning was worthwhile.

Janelle Hollingshead (06:40):

But, eventually I just felt like it just, it wasn't enough. And I didn't know a school that was a modeling school, and so I was like, well, this might not be something I can do. But I actually had a child and was on maternity leave. And during that maternity leave, my department head decided that he wanted to change up what we were doing. He was also tired of the traditional way of doing things. And so I said, when I got back, well, he told me that, and then I told him that like right away I knew of this thing called modeling, like, let's try it. And he goes, all right, let's try it.

And I was like, this is what I want. This is what would make me feel like educationally fulfilled, to come and teach kids how to think for themselves and to think together as a cohesive group versus, you know, do I know how to do what my teacher has shown me to do? Like, can my teacher show me something and explain it so clearly that then I can repeat it. So that was, I guess, how it all started.

Mark Royce (07:52):

So I know you've been working with Larry Dukerich and my wife Brenda on the, with the idea of, around proportional reasoning.

Janelle Hollingshead (08:06):

Yes.

Mark Royce (08:06):

So can you explain to me what the ideas around proportional reasoning and what that's all about?

Janelle Hollingshead (08:13):

I can, I think. It's the "for every" statements that I was talking about, meaning, so if for every one mile, or sorry, for every one hour I go 60 miles. Then if I'm going two hours, can you tell me how far I'm going?

Mark Royce (08:36):

Right. Okay. So what you were talking about earlier.

Janelle Hollingshead (08:39):

Yeah. So, the way that we were traditionally taught, or the way that it is in chemistry textbooks would be, I've got my two miles that I write down, and then I've got this conversion factor of 60 miles divided by one hour. And if I multiply those, the hour in the numerator and denominator will cancel out, and I will get my answer. If instead of two hours, I instead have miles, like 500 miles, I flip that upside down, and then you've got 60 miles on the bottom and one hour on top. Now the units cancel, and then you divide. And the part about that, that I have a problem with is that when I... so I teach a chemistry college class, and some of the kids coming into my class had me and proportional reasoning, and some of the kids did not.

Janelle Hollingshead (09:42):

And the kids that that don't do proportional reasoning get an answer, and they always go, Ms. H, is it Right? Because they haven't thought it through. And they know, we all know that you make mistakes on your calculator. And with that method, if you make a mistake on your calculator because you haven't thought about the answer, you have absolutely no idea if it's right. But my students that use proportional reasoning are going, Hey, you know, if I'm going two hours, then I'm definitely gonna be a number higher than 60. I don't know necessarily what it is, you know, if it's 2.7 or something like that, you don't, but you have like an estimated idea of what it should be, so that if you get a crazy small number, you're like, well, that doesn't make any sense. 'cause it's now more than two miles.

Janelle Hollingshead (10:35):

There's two kind of ways to do it. I think that's two ways that I've learned about. One is, and this is the method that I developed because of Gary Abud and what he said, is to not have an equal sign anywhere in sight and say for every one hour there are 60 miles. And the nice thing for me about this is you can think about it vertically so you can think, okay, two miles is twice as big, so I need a number twice as big as 60. Or you can think about it horizontally because you don't have that equal sign and say, well, there's always 60 miles in an hour, so if I have, you know, two hours, then I need 60 times that number to get the number of miles. And the reason why I like that is it gives students really a freedom to solve this problem the way that their brain naturally lends itself.

Janelle Hollingshead (11:35):

Some of my students really like the vertical, some like the horizontal, some do a mix of both depending on the kind of problem. And I like that there's more than one way to solve that. And then you can also write your, for every statement backwards, right? So again, a student, like for every 60 miles, I, you know, I travel one hour. And so there's like a lot of different ways you could look at it. The one that I'm not as familiar with, but I also really like, is where you go, okay, if I'm going two miles, I know that it's gonna be more than six, it's gonna be more than 60. Uh, I'm sorry, if I'm going two hours, it's gonna be more than 60 miles. So my division over here, is gotta make it so that the number goes up.

Janelle Hollingshead (12:29):

So I know it's between two miles and one mile. So I better have the two miles on top and the one mile on the bottom, and that's gonna make my number of hours go up. And so that's another way that I've seen people. And I like that too. Again, you're predicting your answer and using that as a way to figure it out. And I think also like this, this, I'm not as, so I teach ninth graders proportional reasoning, and that's a whole nother ballpark. There are some kids that really could like, struggle with figuring out that one mile is 60, I'm sorry, one hour is 60 miles. So two hours is twice that much. And so there's a little bit of like, I'll have to ask them, more and more steps. Do you think your answer is gonna be more than 60 or less than 60?

Janelle Hollingshead (13:30):

How come? You could have them draw like a distance that's 60 miles and now that you have two hours, they're gonna draw, a like a length of that might be what twice as much would be. So adding pictures to these for every statements. And then after you ask them, is it gonna increase or decrease, you ask them, do you think you should multiply to get that bigger number or to divide to get that bigger number? And so there's a lot more, smaller steps that's needed to take versus if you have 10th graders or above, I think you could just set that problem to them and say, see if you can figure it out.

Mark Royce (14:12):

So with the work you're doing with Larry and Brenda, you're helping other teachers to learn how to employ this in their classrooms. Is that correct?

Janelle Hollingshead (14:22):

Yes. Yes. So Brenda has taught me how she looks at the problem, which is the one that I'm not as familiar with, but it's the one where you decide what should be in the numerator, based on whether or not you want the number to go up or down. And actually, the beautiful, the beautiful nature of this is that gas laws, that's how kids are taught to do gas laws anyways. So it's kind of cool to have a unifying way of thinking of things that would tie together unit two with all the units. And right now we're working on unit eight. So what I'm doing is I'm learning from Larry and Brenda who, I'm pretty sure, I don't know if I'm wrong about this, but wrote a lot of the curriculum, is what I'm, what I'm guessing.

Janelle Hollingshead (15:14):

And so I'm really learning from them, about how they're kind of, how, how Brenda sees proportions. And then we are trying to make keys right now I was invited to come and to also help them make keys, that will help teachers that haven't seen proportions before feel comfortable, with this idea of proportional reasons. And we're leaving in... like, we're kind of making the keys kind of a little diverse, where sometimes it's traditional, the traditional method that I was talking about, and sometimes it's proportional reasoning so that we understand that, like, I think it's really cool how, as a body we wanna make sure that it's, there's no one right way to do things. There are, there are kids that I've had, they tend to be, like on the spectrum of finding chemistry really, really easy that do gravitate towards that more traditional method. And so I think it's cool to be like, Hey, you know, it doesn't matter the the way you think about it, there's all these different ways of thinking about it, versus just one way and not discounting that way

that's a little bit older than, versus proportional reasoning saying that that's just the now the new cool thing to do that's better than everything.

Mark Royce (16:43):

Hmm. Interesting. Yeah. I know that, well, let me ask you this. What challenges have you personally faced in your career as you've evolved as a teacher?

Janelle Hollingshead (17:03):

As far as modeling is concerned? There's a lot of teachers that don't want to change things because the more traditional way of teaching things work for them as well as parents who are like, what are you doing? This is not how I learned this. This is not what it looked like, and I'm a doctor now, or I'm an engineer, so it worked. You know, why are you changing these things? And then, so you have to have, first of all, an administrator that's really open to science education looking differently. And you have to have coworkers that are open because sometimes you have to teach the same curriculum. Well, in chemistry... that's not so much of a concern, in physics, which is why like physics, the sequence of physics topics is the same in traditional versus modeling.

Janelle Hollingshead (18:03):

But in chemistry, it's totally backwards. You don't start with the proton. You end with proton. So if you have to have the same things on your first semester exam, then you have to have somebody that's willing to at least switch that story, which is hard to do, I think. Because a lot of, I used to be the chemistry teacher that would be like, what do you mean? Like, I used to think that would be ridiculous and crazy to do it backwards. The reason why we do it backwards in modeling chemistry is we teach it the way it was historically taught so that students can uncover the topics in the way that they were historically discovered. If you don't teach it in that particular order, then you have to tell them about everything pretty well. I mean, you can mess with it to a certain degree, but there's a lot of finagling.

Janelle Hollingshead (18:58):

You can talk about like each subject and maybe how that was discovered, but you don't get this continuation like, now let's look at how we build on that. And now we build on that and how we build on that. And so you really, you can't necessarily always employ modeling chemistry just on your own, which is why I almost quit because I had no idea how I, you know, how I would find other science people that would make this shift with me. That's so radical. It's not. And you can for sure, you can for sure teach modeling without the curriculum. You totally can. I just, I was never very successful at it, I guess <laugh> mm-hmm <affirmative>. So I hear that a lot. And I want it to be true. It must be true. But I just, I find it hard to have students discover things in the opposite order they were discovered. And so I guess the three things are student, like students that get triggered really easily. And finding other coworkers that are flexible enough to change the story, the sequence of the story, and also to be open to you doing things differently. Because that gets tricky, where like if you have a coworker that doesn't, and you do, it's like kids will be like, well, I wanna be with that teacher, or I wanna be with that teacher. And you have to be okay with each other and like support each other enough, to be like, you know, these are just two different classrooms. They both rock, you know, and we are unified as a team though, we're different.

Mark Royce (20:40):

Yeah. That's good. So, Janelle, for a new teacher who has just been introduced to modeling or is considering the idea of involving themselves in the modeling instruction approach, what would be your best modeling tips?

Janelle Hollingshead (20:58):

The only way I was able to flourish as a modeler was that I called my mentor teacher from my workshop almost every day, if not every week. I mean, I transcribed everything that Phil Culcasi said <laugh> for probably, probably for four years straight actually. I just kept coming back and kept. And, it's still too hard to do on your own even with all

of that. So we have a ...this is why I don't remember. There used to be a happy hour, which was I think once a month in the evening time where you could come and talk to modelers. I could never make that time. So I made one called coffee hour, which is Saturday mornings, I think it's every second Saturday. And it's 10 central time to 11 central time. I actually started it with a friend of mine named Anne.

Janelle Hollingshead (22:05):

And I don't remember actually how that happened, but <laugh>, we told AMTA that we would like to start it and they let us start it. So every Saturday, every second Saturday morning, basically what happens is whoever shows up shows up, and we go around and I ask everybody to introduce themselves and then say their intentions, which could be, I'm just here to chat, or I'm here to listen. Or I have a specific question about modeling, with my classroom. And then there's usually about three or four people that have been modeling for a long time and we're all able to give different perspectives and different ideas and views, on ways to possibly help whatever is hard for that individual. Because even if you learn modeling, it's gonna look different. If you're in a private school or public school or rural or a city, it's still gonna be different 'cause your kids are gonna be different. And so that's why I think it's important to be a part of a community where you can bounce things off. And me as well, I'll come with intentions. If nobody has an intention, I always have an intention, about things we can talk about that I need help with.

Mark Royce (23:28):

That's cool. So we're gonna put a link to the coffee hour on our website, which is science modeling talks.com. And if you go to episode 79, Janelle's episode, this episode that we're recording right now, we're gonna put a link in there and along with some other things about this episode that you can check out. So if you wanna join Coffee Hour, go to science modeling talks.com, episode 79 for Janelle. And you'll find a link there so you can register and join the Zoom meetings. So, Janelle, do you have any more tips for our listeners?

Janelle Hollingshead (24:12):

Here's some tips for people that cannot use the curriculum, but want to still use the practice. I teach a college credit class and I am not responsible for the curriculum, but I still model in that class. And it looks like this. And I also, this is what I did to insert modeling into my practice before I could use the curriculum. 'cause my other coworkers were on board. So I think the most important thing is what I used to do, and what a lot of teachers do is they start with a lecture. They explain how to do the problem, and then students will do another problem with different numbers to make sure that they understand what they heard. And a way that you can reverse this is, take your lecture notes and your practice problem and give it straight away to the students and have them come up with what they understand about it and what they don't understand about.

Janelle Hollingshead (25:15):

And if they say something like, I don't understand anything, which is gonna be what a lot of them are gonna say, 'cause they're not used to doing this. You talk to them about how you want them to really focus on just the numbers and just circle the numbers that you don't understand and then maybe circle the words that you don't understand, and then come up with questions that could help you access this information from the teacher. So I don't understand where this, what this four, where this four comes from, or I don't understand what this word pressure means, or I don't understand, and help them learn how to ask these specific questions. And I think you can talk to the kids about the fact that your job as a science teacher is not just to impart information, but it's also to create scientists.

Janelle Hollingshead (26:09):

And when you look at, like data from other countries or, you're trying to talk as a doctor to a patient, you've gotta figure out and ask the right questions. And so this is an exercise in asking the right questions that can help you access or help you understand, somebody else, what somebody else is thinking because of that. Like, at the beginning of this exercise, if they've never done something like this before, they'll be like, you are not doing your job, miss teacher or Mr. Teacher, you're supposed to tell me how to do these problems. So you have to have a little bit of a

discussion about why you're changing things. And maybe you don't do that for the whole time. Maybe you just do it for one problem once in a while. It doesn't have to be like every single problem, especially since modeling does go a little bit slower, which makes things challenging.

Janelle Hollingshead (27:04):

So I'll do this a lot of times at the beginning of a unit, and then if I'm like, I'm really getting behind, then maybe, you know, you do more traditional things to go a little bit faster, but they can at least gain the benefit of learning through discussion and learning through questions.

Mark Royce (27:24):

Some really good advice.

Janelle Hollingshead (27:25):

Another really important thing about modeling is how careful they are with words and how careful they are with what words their students use when we're in the learning process. Like for instance, growing up I was always told, and I looked in textbooks and we're talking all the way to when I was getting my national board certification, that energy was the ability to do work. And then I'd be like, okay, what's work? And work was always the ability to transfer energy.

Janelle Hollingshead (28:04):

And I would look at these two definitions and get so frustrated about it. And I thought in my head like, well, what do I know? I mean, this is the way it's being defined in every resource I can find. So maybe I'm just not smart enough to understand what energy is. But actually, AMTA in particular, besides all the other words that I could talk about, we really cherish this word energy and that students understand the words that they're saying when they're saying them. Like for instance, if in my classroom, we blew up a balloon and I said, Hey, how come, you know, how come you feel the balloon kind of pushing back on you? And my students would start to talk about this word pressure, and they know by now that if they use a word like pressure or force or energy, I will say, I'm just curious about how you would define that word.

Janelle Hollingshead (29:03):

What does it mean to you? And,, 99% of the time they look at me and they're like, I don't know. And I'll always be like, isn't this really interesting how we use these words in the right time and in the right way? And when we do that, we all of a sudden feel like we know what we're talking about, but if you don't know what those words mean, do we know what we're talking about? No. We really have no idea what we're talking about. <laugh>. <laugh>. So, you know, we're just really, really, ... People misuse the word force all the time. They'll say the force pushed or the force pulled, or, and you know, I'm like, well, what does the word force mean? And eventually we get to, oh, it means a push or a pull. So you're saying a push pushed and a pull pulled and well, that's not possible.

Janelle Hollingshead (29:54):

A force is not an object that can do something. Or, when they say pressure, they really mean energy. When they say energy, they really mean pressure. Well, what we're trained through our discussion with our students is, can you please say what you'd like to say, but avoid those words? And when you have students do that, they start talking about particles running into things, particles going faster, particles transferring motion, and all of a sudden one, you know what they're thinking. And two, once we come to a consensus, they really understand what's going on. And eventually we can insert those words back into the discussion. But I mean, after a while of not using them, because then it's a time where yes, students do understand these words. But I was just always really, like, when I started doing this myself, I was like, oh my gosh, I don't understand anything anymore, <laugh>.

Janelle Hollingshead (31:01):

I would do the same thing. And my, the incredible part to me about that issue is that, and I tell my students, when I went to buy a house, all of these words I had never heard before being flung in my direction, I'd be like, wait, wait, wait, wait, wait. What do you mean by this word? Wait, what do you mean by this word? And I wasn't afraid to ask because I was so used to asking, what do you mean by that word? I think there's a whole lot of this that goes on in politics or between people that are of two opposing ideas. They're using this one word, but if you really broke it down, maybe it means two different things to two different people. And so to me it's so much deeper than just do you understand your science words? But can you really gain access to something in somebody else's brain by making sure that your vocabulary is understood between the two of you, and make sure that you understand what someone is trying to say to you.

Mark Royce (32:07):

That's really good.

Janelle Hollingshead (32:09):

Yeah.

Mark Royce (32:11):

So Janelle, I really appreciate the investment that you're making of your career into our children's lives by being a great teacher and being a modeling-focused teacher. I think it's really important in the sciences that teachers are learning to use the modeling instruction methodologies in their classroom. And it's also, it's been really fun talking with you. And I hope that the rest of your day in that deep snow back there, <laugh>, <laugh>, it is a good time for you and that you guys are safe and sound.

Janelle Hollingshead (32:50):

Thank you so much. It's been fun being here with you.

