Science Modeling Talks

Episode 81 - ReCast - Modeling at the College Level and Advanced Workshops

Guest: Phil Root

Mark Royce (01:37):

Hey, Phil, how are you doing?

Phil Root (01:40):

Doing good. How about yourself?

Mark Royce (01:42):

I'm good. Enjoying some, finally some less hot weather out here on the West Coast. It's been pretty warm, but this week has cooled down quite a bit, so we're happy

Phil Root (01:54):

<laugh>. Great to hear that Mark. Yeah, we're enjoying that out here in Arizona as well.

Mark Royce (01:58):

Yeah. Are you in Phoenix or are you in one of the surrounding areas?

Phil Root (02:03):

Yeah, so I live in Mesa, in one of the suburbs of Phoenix in the East Valley. And then I work and teach at Scottsdale, Arizona, at Scottsdale Community College.

Mark Royce (02:15):

Cool. That's great. I know you're using the modeling instruction approach in your classrooms. How did you first get introduced to the modeling ideas?

Phil Root (02:29):

So, this is kind of a neat story. When I first started teaching, I was fresh outta Arizona State University with my undergrad in chemistry education, and I was assigned to teach physics. And so when I found that out, I went down the street from Chandler High to Hamilton, and a teacher there basically said, Hey, here's a CD for you. It's not gonna make much sense, but try it out and make sure you take a workshop. And that CD was one of the old school modeling instruction CDs that they used to give out, had the physics curriculum. And I had a lot of fun with the curriculum, but I'll be honest, I totally stumbled my way through it that first year. And luckily got into a workshop the following summer, and that's how I got introduced to modeling instruction.

Mark Royce (03:15):

So it was like a CD rom with like packages of like examples of curriculum or, or presenting the modeling instruction

or how did that work?

Phil Root (03:28):

As I remember it, it was the actual physics curriculum at the time on a compact disc. And it had the teacher notes and the student materials and the labs for the physics materials at that time, which would've been around 2003. And so I had the teacher notes, I had the activities, but I still didn't know what the heck I was doing. As you know, the teacher notes are a great guide, but if you haven't been through a workshop, you don't really know how the pieces fit and how the role of the teacher works as facilitator.

Mark Royce (04:02):

You know, that's still true. The workshops are so important for people who are just getting introduced and starting out on this journey. Of course, instead of a CD ROM now, the AMTA has online resources for similar kinds of things, but much expanded, I'm sure after 20 years.

Phil Root (04:20):

I have no doubt if I went online and used those AMTA resources, if I was starting to teach today, I'd have a much similar experience of fumbling my way through things until I took a workshop.

Mark Royce (04:32):

Yeah. I think that's true. So you started out and now all of a sudden you're, you get your degrees and all that kind of stuff, and now you're teaching at the high school. And you are a modeler at this point,

Phil Root (04:45):

Essentially. Yeah. I remember back when I was even a TA at ASU, I remember my student reflections or my student evaluations were always one of two things. And it was usually either I hated how you really didn't answer my questions and you only asked me questions, or, I loved that you always asked me questions when I asked you questions. And so I think I was a modeler at heart kind of trying to get my students to think. But modeling instruction helped me have the tools to help facilitate that thinking better and gave me more of a pedagogical framework to help my students think, reason and learn and model their universe.

Mark Royce (05:26):

So you taught in the high school for several years, and then you were invited to go over to the college, is it Chandler? Am I remembering that correctly?

Phil Root (05:36):

I was at Chandler High. Quick side note, I took my first workshop at Dobson High and I took that workshop in physics, uh, and Larry Dukerich, I think, was presenting one of the first summers of the modeling chemistry material. So I kept poking my head over there trying to get as much as I could. So I kinda honed my craft teaching at Chandler High, all levels of chemistry, newbies to AP, Advanced Placement and International Baccalaureate, which kind of helped me cut my chops for the college and ended up getting an adjunct gig here at Scottsdale for about a year and a half while I was still teaching at Chandler. And then a position opened up here.

Mark Royce (06:18):

Wow. How cool. So what, how do you see the difference? You had this experience of high school and then college. What is the difference between teaching in the modeling methodology in the high school versus in the college? How would you describe that difference?

Phil Root (06:38):

That's a fantastic question. 'Cause people always ask about high school versus college. I think there's pros and cons to everything. Honestly, it was very difficult at first. When I first got to the community college, we were still a separate lab/lecture, very traditional structure. And I had to use the sequence of the labs that the instructors here before me were using. So it was a kind of a slow process. I would use the lab sequence that they did. I had to reframe the storyline. So I had to rewrite the kind of the sequence and the story to fit the existing progression of labs. Over the course of my career here, we've been able to do two main things. One is get the lab and lecture to be a combined course. So I have the same 24 students from my lab and my lecture class. It's not two separate courses with different groups of students. That allows me to teach all the students in a sequence storyline.

Mark Royce (07:31):

Mm-Hmm.

Phil Root (07:31):

and not have to worry about students having lab and then lecture or lecture and then lab. And then that has allowed us to actually put in the labs that build the story as well. So at our college, the labs are no longer verification labs. Labs are paradigm experiences, introductory experiences as they would be in the high school curriculum. So teaching at a traditional college would be much different. Luckily we were able to change, I guess sort of the scheduling infrastructure here to allow us to adopt a more modeling approach to teaching chemistry, if that makes sense.

Mark Royce (08:11):

Yeah, that's very interesting. So among colleges like yours, you're in a little bit more unique situation it sounds like.

Phil Root (08:23):

And the nice thing our college district has done is that any college that wants to teach the class this way can, they add a little lettering at the end, so instead of chem 130, which is our introductory chemistry, we call it Chem 130 AA instead of Chem 130 and Chem 130 LL. So instead of of registering for two separate courses, the students essentially register for one. Any college can offer it, but there's only about three in the district right now that typically do. So we chose to take that route and it was very intentional on our part.

Mark Royce (08:56):

Yeah, interesting. Now, I read in your bio that you were involved in helping develop the physical science curriculum for the next generation science standards. And I'm really curious about the things you learned in that experience and can you share with us like kind of how that was?

Phil Root (09:21):

Yeah. So, a few years ago, myself, a few other instructors here in Arizona were reached out to, and across the country, I believe, to help with some workshops in Michigan who had just adopted next gen science standards. And they found the AMTA modeling instruction as their way to approach and teach using the next gen science standards. So we went out and worked with a group of us, collaborated, ColleenMcGowan and a few others, to develop curriculum based on modeling instruction that would suit the next gen science standards. That was a great experience for me 'cause it really helped emphasize something that I've grown to recognize as significant in modeling instruction. And that's the idea of storyline. There's so many different ways to tell the story of science or to allow students to have models that build upon one another and tell a story.

Phil Root (10:14):

It's constructing that meaningful story that matters. So I had to think about physics a little bit differently 'cause we had to think about ways energy could tie in. I think we used energy as our thread. I remember calling it the hub. So

we ended up building a physical science curriculum all around energy that involved physics, chemistry, other related concepts that all related back to energy. And it was so much fun getting different perspectives. 'cause I tend to think of things one way with my background, but getting other instructors with their backgrounds, other modelers, I thought about even some physics concepts a little bit differently. Even during the workshop. Just, it was awesome to challenge myself as I was challenging the participants, to think about how we present science in not kind of the standard ways we would think about it as in their silos, a chemistry class or a physics class. That's probably what I enjoyed most about physical sciences is we were just trying to teach about our physical world and it didn't matter what silo we pulled from and it was constructing a meaningful storyline around that that was both challenging and exciting.

Mark Royce (11:17):

Hmm.

Phil Root (11:18):

The guy that's in charge at the state level said, Hey, these guys doing modeling instruction-- This seems to be a way to actually help students achieve cross-cutting concepts, help students see the core ideas. And one of the other fun things I forgot to mention earlier was the engineering applications and the engineering projects. So we had to challenge ourselves to come up with engineering projects that were relevant to the students and relevant to students in that area. So students in Arizona have certain things they're familiar with in context, they understand and that's a lot different in Michigan. So that's kind of the fun piece of curriculum development as well. And challenging part of it.

Mark Royce (11:56):

I guess the thing that's tickling my brain is the idea that modeling instruction had in place when nationally they start looking for standards to apply and promote in the US for teaching. All of a sudden modeling rose to the top, the cream

Phil Root (12:15):

And you know what's interesting is you still see that today, with the push for active engagement at the college is even a buzzword. How do you actively engage your students? And we've been doing it for the better part of 30 years. Yeah. Now we might do it a little bit differently than other groups, but there's actually other curriculums and other groups out there similar to modeling now that are pushing out and trying to help teachers. So I always view it as AMTA was actively engaging students before it was cool.

Mark Royce (12:48):

Yeah. That's awesome. So I know that you've been involved in leading a lot of workshops since you got involved with modeling. Talk to us a little bit about the advanced workshops, because I know there's the introductory chem one and physics, I don't know if they call it physics one or whatever. There's the different AMTA workshops that introduce people to modeling and get 'em started on their journey. Talk to me about the advanced workshops. Let's do a little promotion here and let people know about the advanced workshops for those who haven't been through them. And especially you've done a variety of them. So let's talk about what you've experienced in leading those different discipline areas.

Phil Root (13:38):

Yeah, so the much like physics has the first semester, the intro physics kind of mechanics workshop and branches out. Chemistry started off with that three week kind of introductory workshop that got through, I believe it was like the first nine units, is typically what a chem one workshop does, which is honestly most of what a high school teacher will teach in their first year of high school chemistry. But you might be missing a few topics. So back in the, was it the late two thousands, Larry Dukerich and Guy Ashkenazi had done a series of what they called Chem

two workshops, developed some materials and some of those materials eventually were left out of the chem two workshop, migrated other areas, but was still really good stuff. So eventually there was interest in, Hey, can we get chemistry and physics instructors some more content?

Phil Root (14:34):

And personally I love the area of thermodynamics, entropy, work. There's all kinds of connections to physics and chemistry. So our first undertaking was actually to take some of the really neat work that Guy and Larry did with some of the entropy concepts and build that out to include some of the physics concepts of work expansion and thermodynamics. And we offer that and we encourage both physics and chemistry teachers to take it. In fact, it's always better when we have a good mix of the two. 'cause they challenge each other in different ways. And so we really challenge teachers of both disciplines and any discipline really to think more about the concept of energy transfer, working and even the math and the calculus involved with that. So that's been a lot of fun, and what entropy really is. And we try to put disorder on our banned word list, for example.

Phil Root (15:28):

'cause a lot of people just associate entropy with disorder. So we really try to dig into that. And that was built off of a framework that Larry and Guy had established, but that had, there was barely any time in the two week chem two workshop. So that's kind of where we started. After that, that actually started as only a two week workshop as well. And then we're like, wait a minute, teachers, a lot of these teachers are trying to either get dual enrollment certification or they're trying to get their master's degrees. They want more than two credits. So we actually expanded out that thermo chemistry to a three week workshop now. We also include topics related to electrochemistry, which is a lot of fun. And so we add those, some extra pieces and we even added a little bit more physics at the front end. So it just really gives a more robust treatment of energy and thermodynamics than you would get in either the physics or the chemistry intro workshops.

Mark Royce (16:24):

Hmm. That's really cool.

Phil Root (16:27):

And so the other workshop we expanded was the second, they call it chem two. It's like the second half of chemistry. That was originally a two week workshop that went over the remaining units. And we were able to build that out. Levi Torson, who is at Estrella Mountain Community College, him and I have led a lot of workshops together. And we use these materials in our intro and our general chemistry courses. So we were able to bring that experience as well as my high school experience and our thoughts and development of curriculum to actually build out that chem two to be a three week workshop with the more extensive treatment of acids and bases and kinetics. Previously there wasn't a kinetics unit, so we had a lot of fun actually taking all the stuff we've done based on our modeling backgrounds and actually building out a brand new unit to our chem two materials and kind of fully developing that. So that was a lot of fun.

Mark Royce (17:19):

Now, I assume that the advanced workshops are also promoted on the AMTA website. Is that correct? If someone's listening to this and they go, Hmm, I'd like to check out one of those workshops. They could find it at modelinginstruction.org. Modeling instruction.org. And, what would you say people that wanna attend those workshops might expect if they sign up?

Phil Root (17:48):

Oh, what a great question, Mark. First they're not always offered every summer. They're kind of offered on a rotating basis. Because we try to meet the demand. What teachers can expect? I would say number one is to be challenged. We challenge a lot of, I would say, preconceptions. I've even been challenged myself as a workshop. I would

say, Levi and I both would say this, every time we lead one of these advanced workshops, we feel challenged. So we like to think about things a little differently. We like to challenge our participants to think about things differently. The other thing I would say is be prepared to take with you things that you can use right away in your classroom. You're probably not going to, I won't even say probably. I don't think any teacher's ever going to use all the units that we do in our thermo chemistry or our thermodynamics workshop. Excuse me. I don't think any teacher's gonna use every unit we teach in our chem two workshop. But you will have activities, labs, facilitation experience that you can take with you directly back to your classroom the next year and put it to place right away to build your storyline in your classroom and make it stronger. That's probably my biggest selling point.

Mark Royce (19:00):

Do you have any workshops coming up?

Phil Root (19:03):

So this summer, I believe there will be Chem one workshop here locally in Arizona. There's a variety of workshops across the nation. And again, you'd want to go to modeling instruction.org for that information. I don't think our advanced workshops are currently on the books, because of the rotating schedule. So last summer was chem two, the summer before that was thermodynamics. So I would look for thermodynamics coming up in probably two summers from now. But do always keep an eye out on the workshop. 'cause every now and again, these advanced workshops will be offered to different places around the country, not just at ASU.

Mark Royce (19:40):

Right. Cool. So you've been teaching since 2004, if I remember correctly. Um, that's 20 years. Just a reminder,

Phil Root (19:54):

You're telling me, I know. Hard to believe.

Mark Royce (19:58):

So here's my question. How have you changed as a teacher since you started with modeling?

Phil Root (20:08):

I think the biggest thing that's changed, and I'm actually very explicit with this, with my students. I remember my first year of teaching, I was mainly teaching physics, stumbling my way through the modeling curriculum. And I had one class of chemistry. And I remember using this phrase, just do the problems this way. This is Mr. Root's method of success. And I was trying to tell my chemistry students or my physics students how to solve their problems rather than trying to help them facilitate their thinking and facilitate their learning. And in the last 20 years, I'd say I'm a much different teacher from that perspective. My goal now isn't to get my students to solve a problem a certain way or to get an answer. It's to probe their thinking about the relationships that they're using or how are they making sense of the mathematical relationships they're using or the conceptual frameworks that they're building.

Phil Root (21:10):

And so it's really been that transition from the sage on the stage to more of that guide by the side and facilitating. And now, instead of trying to, I remember, I think even when I was at Chandler trying to look for certain solution methods or certain ideas on whiteboards during whiteboard sessions or class conversations and trying to see specific things and trying to help my students see a way to solve the problem. Now I get excited and I try to encourage students. I wanna see as many different approaches to this as I can on these boards. I wanna see something I've never seen before. Think about a problem I haven't thought of in that way before. And to help my, mainly so that my students are seeing different ways of thinking about things so that they can find a way that they understand that is also in alignment with the data and our observations.

Phil Root (22:04):

So if you can understand, we all see the universe differently. That's kind of the beautiful part about the human experience. We all are our own people with our own individual models. I'm never gonna have students that have the same scientific models of the universe that I have. That would be a travesty, actually <laugh> if everybody thought the same way. However, I do want my students to be able to think and reason in a way that makes sense to them and build their own personal models of the universe that are built on data, built on evidence, and built on reason. And I think that shift away from solving problems and getting answers to helping my students think about their universe is probably the biggest shift I've had.

Mark Royce (22:45):

That's awesome, man. And good wise words for those who are listening, those of us who are hearing your words. I'm curious, like if you're speaking to a room full of newbies, like just getting going with the modeling instruction, what would be your top advice, your tips that would help them grow more quickly, maybe save them some pain and help get them going in the best way possible? What would be your top tips?

Phil Root (23:26):

Probably number one would be to give yourself a break and give yourself a hug. This is hard work. It's challenging work. And a lot of times how well a conversation goes in class or how well a lesson or discussion goes could have nothing to do with you as the facilitator. It could have more to do with what the students were talking about or thinking about, psychological things and psychological biases play both for students and instructors. So recognizing that we have limited influence sometimes, but we wanna cherish that influence. Make it everything it can be. But don't be too hard on yourself when things don't go well. And to use those as learning opportunities. Maybe it had nothing to do with you or your preparation and to just trust that you'll have other opportunities to try different things and see what happens.

Phil Root (24:20):

Second thing I'd probably advise the young students is not try to do too much too early. Early in my career, I tried to do too much early on, content wise, not realizing that with a modeling cycle and the way modeling instruction works, if we don't understand something the first time as a class, we're probably gonna see it again later and again later. So it might not be until the second, third or fourth time that a concept comes up in an even a later unit that the students might grasp it. So recognizing that that learning cycle, that modeling cycle allows for that growth and not to try to shove too much content in too early.

Mark Royce (25:02):

That's good.

Phil Root (25:03):

Probably the last thing I would say to new teachers is keep a little bit of a journal. We ask our students to keep a learning journal. We encourage our teachers in our workshops to journal through the workshop. I would keep a little journal of what you kind of did, how things went. A that helps you the next time you go through and you teach that lesson, you can reflect on what you did the first time. And it's kind of fun to look back at your notes and go, wow, I really did that five years ago? Not to belittle yourself in what you did, but go, oh wow, I tried that. Look at what I'm doing now. So it's kind of neat to see your growth and one of the only ways to see that growth and to really appreciate that is to have some of those notes laying around or some of those journals laying around. So that would be another thing I would encourage younger teachers to think about.

Mark Royce (25:51):

One thing I always think about for new teachers is classroom management. And you know how that's sometimes

kind of shocking when they first start teaching, the need for skill in that area. What have you learned? And I know it's gotta be different in college than in high school anyway. You wanna address that a little bit?

Phil Root (26:13):

I think in terms of classroom management expectations are important. I've never really had an issue with classroom management. 'cause I don't know if it's just my personality or whatnot, you know, if we're always working, we're always doing stuff. But I think it's important to expect a lot outta your students. Expect them to be able to do the hard challenging things. And when they can't, allow them to be vulnerable. Allow them to be in a safe place where it's okay to not understand. Because otherwise that hard work can't happen. I do think it's important to have your students be engaged. They have to understand, for me, they understand that from the minute they walk in the door to when the bell rings, if it's at a high school or to when class ends, we're doing stuff. You know, we're there for a reason.

Phil Root (26:59):

We're trying, we have clear goals, clear expectations. And I found that even back at the high school days when I asked the students to do things and they understood I actually believed they could, they didn't want to mess around and frankly they didn't have time to mess around. And I know that's not gonna be an easy fix for everyone and not everyone's gonna have the same issues. But I think when you expect a lot outta your students, you do that consistently on a daily basis and they know that there's authentic belief that both frustration is okay and success can happen. Those management issues tend to to go away a lot more.

Mark Royce (27:40):

Is there anything that you thought we might talk about that we haven't talked about?

Phil Root (27:45):

In the last couple three years, I've had the pleasure of working with a lot of great colleagues. Here at SEC, Mitch Sweet, who is a Chem one workshop leader, has been hired on as faculty here. We had an adjunct, Justin Sheets here at SEC who just got hired on full time at another local college Chan Gilbert. I've worked a lot with Levi Torreson over at Estrella Mountain and Fiona Elise over there, Alan Reyes and Mel is over there as well. So I've had a lot of great colleagues to work with. And what that's really helped do is facilitate and grow ideas and think about things a little differently. Specifically working with Justin Mitch, thinking about how we hold classroom conversations. I know in modeling instruction we really emphasize board meetings. But in my opinion, and this might help new teachers as well, one of the most important things in the class is when the students are talking, that's usually in preparing whiteboards or talking with groups. Students are used to chatting with each other. Two or three students, three or four students. When we get into that whole class conversation, things sometimes shut down. And my buddy Justin brought up a great point. How often do we have conversations with 20 other people?

Phil Root (29:03):

You usually don't. So Justin brought some great advice, of talking to his students about that and being explicit with them. Hey, it's tough to have a conversation with 20 people. Some of you're probably gonna talk a little more. Some of you're gonna talk a little less. Just bring your best authentic self to this conversation. And having that kind of explicit discussion with students has really helped. And then I also found that as I've moved through my career, I emphasize those whiteboard group discussions a lot less. And I emphasize group chat a lot more. Even chats between groups, so groups presenting to other groups. And that's something else you get out of these advanced workshops is a lot more techniques on how to conduct and facilitate classroom conversation, how to conduct and facilitate whiteboard discussions and whiteboard sessions. And there's so many different ways to do it than I realized when I first started. So that's another thing that's cool, is kind of thinking about how to get those students talking and how to get them engaged. And sometimes it's less whole group, whole class conversation and sometimes it's just being authentic with them and explicit with them in terms of expectations for those whole group conversations. So that's

been a pretty cool learning experience that only happened by working with other people.

Mark Royce (30:21):

Right. The collaboration of community

Phil Root (30:25):

A hundred percent. And I think that sometimes we talk about that with teachers who are coming from a district and they're the only modeler in their district. So I would encourage teachers that are in that situation to find your community. If it's someone in another district, someone in another state, even. If you can at least find one person to connect with and start building a community, it just makes the work more fun. And you get that better diversity of thought and opinion that can help strengthen your own skillset and help strengthen your classroom experience.

Mark Royce (30:54):

If you are out there alone a little bit, also, the AMTA has resources online to help you get connected with others in conversations. And I know they have, I don't know all this stuff, but like discourse is one place where people connect and other social media outlets.

Phil Root (31:14):

So nowadays it's even easier than it was 20 years ago, obviously, to get connected. So I would echo your statements there, Mark, and your sentiment that get connected and use those resources that the AMTA provides to help you connect with others and build each other up and build that curriculum and build your experience.

Mark Royce (31:35):

Well, Phil, it's been awesome talking with you, man. I've really, really enjoyed our conversation and I think you have some really great insights to share with our listeners. And, we have a lot of listeners and a lot of people in the community. And so wherever you get your podcast, you can hear this, of course. And this one will launch on November 1st, 2024.

Phil Root (32:03):

Excellent.

Mark Royce (32:03):

Episode 62, so people can find it there. Or on our website, science modeling talks.com, we'll have it posted there along with this conversation. We also post anything that you may have mentioned that you're talking about links and any links you wanna send me, Phil, that you think will be important for people, we can share them on that website and they can read your bio and do all kinds of cool stuff there.

Phil Root (32:37):

Awesome.

Mark Royce (32:39):

Get linked in with you. Well, sir, thank you so much for taking the time to do this.

Phil Root (32:45):

Absolutely. Thank you for having me. Thank you for having me on the show and to everybody out there listening, thanks for listening and keep at it, keep facilitating and keep up your practice. Yeah,

Mark Royce (32:54):

That's great man. Thanks.

Phil Root (32:56):

Awesome. Thank you, Mark.