Science Modeling Talks

Episode 74 - "40 years veteran teacher and Modeling Workshop Leader"

Guest: Tom Pfeiffer

Mark Royce (01:31):

Hi, Tom. How are you doing today?

Tom Pfeiffer (01:33):

I'm doing pretty well. How are you, Mark?

Mark Royce (01:35):

I'm good, thank you. Good to meet you too, man. This is awesome. I'm looking forward to talking to you with your experience. It's just awesome. So, you're retired now?

Tom Pfeiffer (01:51):

Yeah, I just retired, at the end of June.

Mark Royce (01:54):

Yeah. You know, interesting. Same time as my wife. But before you retired, you taught for 40 years?

Tom Pfeiffer (02:06):

Yeah, 40 years.

Mark Royce (02:06):

And I know that you were using modeling instruction for about 30 of those years,

Tom Pfeiffer (02:13):

Actually closer, more to 25. Yeah.

Mark Royce (02:16):

Okay. Okay. 25 years. But that's pretty early in the development of the modeling instruction approaches.

Tom Pfeiffer (02:24):

Right. Right.

Mark Royce (02:24):

And, so because you've got all this great experience, I want to ask you what you would share with teachers who are just getting going. Like what would you say to a teacher says, I'm starting and I'm looking at this modeling thing.

What do you think of it?

Tom Pfeiffer (02:43):

Well, for me, I think the biggest thing was ... I noticed that when I started modeling in physics in 2002, I saw just a lot more engagement from students, than I had up to that point. So I'm about 15 to 17 years into teaching. I had gone through the... How am I gonna do this? So I sort of was teaching the way I had been taught to, you know, lecture, lab. It was very passive. That approach worked for me. I was very interested. I absorbed the information and figured it out, but that's not how most people are. So I was noticing that it was very passive and kids were maybe not getting what I would hope that they would've would get out of it. And they just didn't seem to have the buy-in. So, when I started with the modeling, they were much more... I just would notice that they were much more working together, cooperating, much more willing to be engaged.

Mark Royce (03:54):

That's cool. So I read that you said that modeling instruction requires, here's a quote, requires students to be responsible for building their own knowledge, and it makes them have to take more chances. Talk to me. Tell me what you mean by all that.

Tom Pfeiffer (04:12):

Well, I think, it's more of a constructivist approach to, you know, I think, at least when I first started teaching or my, I envision teaching as sort of like filling an empty glass full of knowledge. Right? And that's not how it works, because you give them all this information and they have no way to file that information and to make the connections to their prior knowledge. So it's all jumbled up. And if they have to retrieve something, they have to go through the entire, their entire memory to find that little piece of information. It may or may not be appropriate. Whereas I think with the modeling approach, it allows students to take that information and to make connections to prior knowledge.

Tom Pfeiffer (05:12):

So it's much easier for them to retrieve the information. So it's kind of, we had, in one of the modeling workshops, I think it was maybe the first or the second chem modeling workshop I did, we read a book basically called How People Learn. And that sort of explained quite well how, that you construct your knowledge, you take it in and you build on what you previously have in your mind, and you're making the connections so that when you have to say, solve a problem, you know exactly where to go to get that information. It's like when you're a carpenter, you know exactly what tool you need to use, whereas if you're just somebody off the street, you know, you might have to go through and it might take you a while to find the right tool.

Mark Royce (06:02):

Yeah. Wow. That's good. So, have you always taught in a high school setting?

Tom Pfeiffer (06:12):

Yeah, I taught at the same place. I started in 1985 and decided I really liked it, so I stayed at the same place. So it's a pre-K through 12 school. So, I've always been the nine through 12, science, one of the nine through 12 science teachers.

Mark Royce (06:32):

And you taught all the disciplines in the sciences?

Tom Pfeiffer (06:35):

Well, everything except for Earth Science. My first year I had, five different preps. It was physics, chemistry, 10th

grade biology, and then an advanced biology, which was different, for older kids, not necessarily AP, but it was just different topics in biology. And then I taught like a IPS physical science. That was, maybe half and half of chemistry and physics. Um, so that's how I started. And then as the school grew and my responsibilities kind of narrowed down to physics, chemistry, and then the IPS has sort of, I've took that and I created two, like an intro level physics, like a physics first type class. And then, sort of an intro to chemistry class that I followed modeling principles, I guess, but it's more appropriate for ninth and 10th graders.

Mark Royce (07:51):

Yeah. You said physics first, so ninth grade physics.

Tom Pfeiffer (07:54):

Yeah. But it's really more ninth and 10th. There's obviously much less math involved in that level of physics. But even with the less math, many kids don't have the math in early ninth grade, so sometimes they'll wait till 10th grade to take it.

Mark Royce (08:15):

Yeah. Gotcha. Gotcha. Did you ever teach the 11 and 12th grade students?

Tom Pfeiffer (08:20):

Oh, yeah. I've taught that all the way through. So yeah, that's what I started with. You know, physics and chemistry. So that's, the physics was mostly 12th graders and some 11th graders. And then chemistry was anywhere from mostly 11th grade, some 12th graders and some 10th graders. Yeah.

Mark Royce (08:39):

Wow. Yeah. So, was there any of those disciplines that you focused on more primarily: physics, chemistry?

Tom Pfeiffer (08:49):

Well, when I think back to like my undergraduate, I started off as a biology major. And I realized pretty early on that I really liked chemistry, and I was really good at chemistry, and it came really easy to me. And it just seemed like that was, a better way forward. I continued on with the biology, but I definitely did chemistry also. So I had kind of a double major. And then I did biochemistry as a grad student for a couple years. I was in a PhD program. And after a couple years of that, that was, I decided that was probably not the direction that I wanted to go in. So I really had a very good background in chemistry. I had taken enough physics to understand, you know, the basics to be able to teach it at the high school level.

Tom Pfeiffer (09:38):

But that was really where I needed to work on. So I would look for classes to take. So I learned a little bit more physics, sort of self-taught classes. I did several institutes at Bates College, in Maine, in the late eighties and nineties. And that's sort of where I got first introduced to modeling instruction. Jeff Steiner. He would go to those. So I knew him from going to those workshops. And one year, probably late nineties, he did a little presentation on modeling instruction. And that's sort of what piqued my interest. And, you know, within a couple years, the workshops became available and my school was very generous in allowing for professional development. You could take the equivalent of six grad credits, and they would reimburse, they would reimburse you. So, as soon as I knew modeling, I mean, I didn't know all about modeling, but I knew enough to where, oh, this is really interesting. And that's where... So it was like 2002, summer of 2002 that I took my first modeling physics class, and that was in Morehead City, North Carolina.

Mark Royce (11:05):

Do you find a lot of difference in the classroom between teaching physics versus teaching chemistry using modeling approach?

Tom Pfeiffer (11:14):

Well, you know, it's different-- different subjects. And I think chemistry has a lot more content. Physics is kind of, you have these basic models and then a lot of it is just, okay, you're gonna apply the model to solve these problems. So, you know, there's equations and there's graphs and motion maps and all of that. But it's pretty -- I think of it as more, you're laying out the skeleton and then you allow them to use the information to solve problems. Whereas chemistry is a lot more content, you know, just to be basic, just the symbols and the formulas and all of that. So it's a little bit more content-dense. But in a way, I mean, when I think about my classroom, and I ask kids, well, you know, how has physics been different for you than chemistry?

Tom Pfeiffer (12:07):

And they say, well, it's the same teacher. They don't really perceive a big difference in the way the class is run. I mean, it starts with an experiment, a paradigm experiment, if you wanna call it that, where you uncover some phenomena and then you try to model what it is. And then you work through the unit. You deploy the model and worksheets, and maybe you do another, like a lab practicum or something along those lines. And then, you know, you get to the end and then, you know, you take a test and you also realize that your model kind of, oh, well, we need to add something to it, or we need to modify it. And then so we'd, oh, well, what about non-uniform motion? Or, oh, how do we explain diffusion? Well, it looks like we need to take our basic model.

Tom Pfeiffer (12:59):

And then add to that. So, oh, you know, we do a little experiment to get ready for the second unit. Oh, what did we observe here? Oh, you know cart rolling down a ramp is behaving differently than the constant motion buggy. Or, how do I explain this liquid expanding when I heat it and contracting when I cool it? Or why do I smell butter when I am popping microwave popcorn? You know, I have a video of Brenda doing that in her class. I would use that, during the pandemic, because of course, kids were at home and they were learning remotely. So,

Mark Royce (13:42):

Oh, I have to let her know that someone else actually used her video. That's cool. So I know that you've been a modeling workshop leader as well. I was told this.

Tom Pfeiffer (13:57):

Yeah. I started, it must have been, '13 or '14, I think, 2013 or 2014, I can't remember which. I was actually taking an advanced modeling workshop in Mansfield, Pennsylvania. So part of the fun thing about taking workshops is you get to go all over the country and go to new places. So I was at Mansfield College, in Pennsylvania. And, we were just working just, it was just, Hey, work on this. So we were working on a unit, electrochemistry and redox, and, it ended up not being used by modeling, but it was a fun, good experience. And so there was somebody from Vermont that was there, and I caught a ride back with them, and she said, oh, I'm heading over to Kennebunk to take a workshop, from Jamie Vasenka, a physics workshop.

Tom Pfeiffer (15:03):

And it's like, oh, okay. And somehow, I got on the phone with Jamie and, he says, oh, you should come and do a week of the workshop. And I said, well, I've already done a physics, oh, come on over. Oh, you do chemistry modeling. Oh, we have to talk about that. So we talked about it, and he says, oh, well, we would really like you to lead a workshop up here on chemistry. And it's like, well, okay. So further conversations, and next year I'm doing the workshop in Kennebunk, the chemistry workshop. So that's kind of, it was just sort of a chance, you know, all the

stars got aligned properly and Jamie roped me into doing the workshop. And I've been really, I really enjoy doing the workshops. It's totally different than working with kids, of course. But, adults have their own quirks, you know. But it's fun. And, and I feel like I'm helping, sort of helping, repaying all the, you know, when I think about all the classes I took in my career, it's nice to be able to give back. And also to be able to help teachers to work with students and improve their students' instruction. So, yeah. Yeah.

Mark Royce (16:26):

So you've taught several workshops over the years now? Primarily in chemistry? Or have you done physics workshops?

Tom Pfeiffer (16:34):

No, actually, it would be kind of fun to do a physics workshop. I would, you know, because I started modeling physics probably four years before I did the chemistry. So I've been doing that more, uh, longer. But I've done the chemistry primarily the first... The core material. And then, when we did the pandemic, I did a couple of, beyond the core workshops, all remote. So, yeah, we did the, we did the workshops remotely from 2020 through to, this is the first year we went back to, in person.

Mark Royce (17:19):

So if you were promoting a workshop, what would be, how would you draw people in to want to attend your workshop? What would be kind of maybe some critical concepts that you could share that you're going to be sharing in your workshop, you know, make a pitch?

Tom Pfeiffer (17:37):

Well, I think, you know, most teachers wanna do what's right for the students. They want to engage their students. They want the classroom to be a fun place. Not just fun, you know, blow stuff up and all that. But, to make it fun in a very directed way, and to get kids more engaged and to take more responsibility for their learning. Plus they're gonna develop skills that they'll be able to use beyond your classroom. So for me, you know, I was 17 years into teaching when I first started modeling, and I don't know if I would've made it 40 years, if I was teaching traditional. I was a good teacher and I had certainly made my share of mistakes and learned from them and improved my class.

Tom Pfeiffer (18:32):

But I think it was a real leap when I went from traditional to modeling. I think I get to know students more that way. And they get to know me more. The class isn't focused on the instructor, it's the kids. They're actually working together. They're working on their own. And that's what we want. We wanna get students to be able to work independently, but to also be able to collaborate. So I'm kind of all over the map here, but I just think it's, when I think of my students post modeling or when I was modeling, they were much more engaged and seemed to enjoy the class more. Whereas before they just kind of sat back and absorbed the information. And I'm not really sure, when I think about like 10 year, five years or 10 years after they take your class, I think that what happens in the modeling classroom will stick with them, not necessarily content, but the skills that they develop that they'll be able to use.

Tom Pfeiffer (19:45):

Whereas if they're just sitting there, listening to you drone on about energy levels or orbitals or whatever, are they really going to remember that? Are they gonna have developed any skills that they'll use from that? So, like I say, I'm kind of all over the map, but I just think it's a much better environment, much more fun for me. In the listserv I've seen this several times, and I don't know if I agree with a hundred percent, but the mention that I feel like I'm being, I'm obsolete. I'm able to walk around my classroom and the students are doing all the work, and I'm just sort of sitting there observing all of this, and, you know, you're not really obsolete. You're really helping and guiding and

Tom Pfeiffer (20:37):

Maybe, you know, but it's fun to watch them work in a self-directed way as opposed to you having to lead them. You know, all the time. So that was to me, so that made teaching way more enjoyable for me, and I think it allowed me to go on longer than I might've been able to. I felt like I was still at the top of my game doing a good job. I'm not sure after doing lecture and lab for 40 years, if I would've been able to do that for 40 years. I might've gotten tired of the sound of my own voice and <laugh> pack it in, you know?

Mark Royce (21:15):

Yeah. My wife, um, says that, one of the main things she's doing is teaching the students how to learn.

Tom Pfeiffer (21:25):

Yeah.

Mark Royce (21:26):

When they walk away from my class, regardless of the content they carry with them, they are learning how to learn, and that will always go with them in their life ahead.

Tom Pfeiffer (21:37):

I think that sums up what I just said. It took me 10 minutes to say is that they're developing skills, being able to work with people, they're able to take a novel situation and use what they've learned to solve that. Certainly using the models and the multiple representations helps them come up with a path to the answer. And being able to think on your feet, you know, you're up there and I mean, I remember as a kid, I was terrified to get up in front of a class and make a speech, they, you know, I mean, there's always a few kids that are very shy, but they're much more willing to do that. And I just think it's gonna help a lot. And even in interviews or they, who knows, they may find themselves leading a group of people at work and they'll have to be able to have those skills to communicate.

Mark Royce (22:36):

Regarding the workshops that you've taught, I'm curious, can you just share maybe one or two of the most important critical concepts that you share with those teachers who are in attendance of the workshop? What would you say this is absolutely critical to learn as a teacher in these modeling workshops?

Tom Pfeiffer (22:57):

Listen more, talk less, you know, really be there. Try to draw the student out. You're there to ask questions, how to, you know, ask those questions. And of course, if somebody is presenting a whiteboard that might not be entirely correct. You have to try to not correct them in a, oh, this is the wrong answer, and then explain why, and then give them the right answer. You have to try to prod the student into coming to it on their own. It's just trying to get, trying to draw the student a lot more. You're more of a coach, and not a dispenser of knowledge. So, yeah. I think that's the, I guess that's the big idea. You know, one of the big ideas, trying to hear more from students and less from you, of course, you have to sum things up or you have to try to maybe ask them questions to direct them. But you really want to listen to the student and get them to show you, demonstrate what they know.

Mark Royce (24:15):

You mentioned to correct a whiteboard, but we hadn't talked about whiteboards, but I assume you use whiteboards quite a bit. What was your experience with using whiteboards in the classroom?

Tom Pfeiffer (24:29):

Oh, I use 'em every day. Whether it's tabulating their data, you know, or working on problems from worksheets.

And, again, it's a great way to get the students to take center stage as opposed to the teacher. One of the skills that you have to have as a teacher is to be able to, sometimes you get up there and there's a perfect whiteboard, and it's like, now I really have to work. And I really have to, so I have to alright, it's a perfect whiteboard, so I have to take a different approach. So, well, what if, or why did you do this or that? Or what would happen if this, if you did this or that? And so a perfect whiteboard is something that would shut the whole thing down, and then you'd go on to the next person.

Tom Pfeiffer (25:26):

It's like, well, no, I'm not gonna let you off the hook. You know, I'm gonna probe a little deeper here. Um, and then of course, people who are, maybe they might not have a perfect whiteboard, or they might have made a little mistake along the way, you can generally get them to see that. And I try to get them to where they can... They don't wilt when they realize that they've made a mistake and Oh my God. You know, it's like, well, no, it's okay. Just we'll correct it on the fly. We'll talk you into a soft landing. That's a Larry Dukerich quote.

Mark Royce (25:59):

Yeah. Yeah.

Tom Pfeiffer (26:00):

And I love it when I can get kids to do that and, oh, we did this, or we did that. And they'll go back and they'll make the change, and everybody's very respectful. We're waiting and, you know. That generally doesn't take very long. And then they get up there and it's like, oh, you know, great. You did a great job. You know, and you could just see that they feel really good that they were able to be able to withstand being up in front of their peers and not being perfect, and maybe making a little mistake, but then realizing it and being able to make the correction.

Mark Royce (26:35):

In the workshops. I'm curious about what the reaction of participants in the workshop are when you teach how to about whiteboarding.

Tom Pfeiffer (26:46):

Well, I think, generally it's received in a very positive way, and they're very intrigued with how you, you know, how do you interact with students. So I think they're like, they're there to really learn how to engage in conversations with their students. And, you know, so I try to give them some pointers and it's like, oh, this is a, like, I mean, I know the problems enough to know where kids tend to stumble or make mistakes. So I'll say, Hey, this is, you know, uh, this is a common mistake that a student would make. And, then I might turn it on to them. It's like, well, alright, if I'm up here and I've got this, talk me into a soft landing here, help me understand. And then I try to get them to be the teacher, and I'm the student and I'm being a little like dense or recalcitrant, and I don't understand why, and I try to draw them out a little bit. And, and so they like that a lot.

Mark Royce (27:51):

That's cool. That's really cool. In your experience in the school setting, classroom setting, what are your thoughts about the relationship between teacher and student?

Tom Pfeiffer (28:07):

Well, I think it's critical that you know as much about your students, as possible. And also to try to have some kind of a working relationship with them. They're young, they're impressionable. They're going through all kinds of things. I remember being a teenager, it was a while ago, but I remember, and some of them, they're different. And so some are very willing to be asked questions and to, and to probe. And if they've made a mistake, they're resilient enough to be able to go through it. But then there are other kids that are not, they're anxious and they're worried

about their peers. So you have to know when, how far you can go before somebody, you know, before they shut down.

Tom Pfeiffer (29:00):

When you're assigning problems. There are different levels of difficulty, and you need to know your students well enough to know that, oh, this is a, maybe the more difficult problem on the worksheet, and I'm gonna not necessarily give that problem to the weakest student or to the student that, you know -- the anxious, the student. So you need to be able to select problems for different groups. And I have the groups change every week, so it's not like I have the same kids working together. So for me, I just found it really helpful to be able to like match the problem with the group. I want them to be successful. I don't want it to be too easy for them, but I also don't want it to be impossible. So, you know, you're trying to set them up to achieve just the right amount of frustration. You want them, a little bit of frustration is okay, they can work through that and they eventually get it, but if you get too frustrated, then they shut down and then it's counterproductive, and then you have a problem that you gotta deal with because they're, they're not engaged anymore.

Mark Royce (30:14):

Yeah. Wow.

Tom Pfeiffer (30:15):

I mean, it's like any type of athletic training. I mean, you can go too hard, or not hard enough. You have to find just the right, the sweet spot there to where they're getting a good workout, but they're not like, overdoing it or you're not wasting their time.

Mark Royce (30:33):

That's really good. Well, you're retired. Are you gonna continue to do workshops at all? Have you thought about that?

Tom Pfeiffer (30:46):

Yeah, actually, I've really enjoyed it. And now that I'm living in the West Coast, I'm, you know, I still wanna do the workshop in Kennebunk. So I've committed for another year to do that. That's a good way for me to get back to the East Coast so I can visit friends in Vermont as well. So I'm would like to, I would like to definitely continue on doing that. I mean, I'm 68 and I feel like I could do it for a few more years. I wouldn't mind doing other workshops as well. I know that Sue had asked me to do a workshop, like an implementation workshop, starting like in August for new teachers, kind of help them. So I definitely would be willing to maybe do that the following year, and if another workshop came up, I would be very happy to get involved. It's always fun to meet other teachers and go to different places.

Mark Royce (31:54):

Well, maybe that workshop that Sue suggested, maybe you could help develop that. It doesn't sound to me like it's really something that's been done much.

Tom Pfeiffer (32:04):

Yeah. Yeah. And it's definitely, a remote or virtual, which I found actually...I did five years of online workshops and I felt like I had it down pretty well. I felt pretty happy about the outcome of those workshops. I felt like participants left those online workshops with pretty much the same that they would have left the in-person workshop with.

Mark Royce (32:36):

Yeah. That's cool. Maybe you could also help spreading the modeling news in Washington, <laugh> in the Washing-

ton area.

Tom Pfeiffer (32:46):

Are there any workshops up here?

Mark Royce (32:49):

I have no idea. I have no, that would be a Sue question.

Tom Pfeiffer (32:52):

That might be kind of fun to get something I don't wanna take away from Jamie, but I mean, you know, I think, yeah, there's probably plenty of you know, I'm sure there's a big pool of people out there that wanna do modeling and Yeah. And, I think the remote workshops are really important to keep, because I know that at least from the years that I did it, there are a lot of people that never would've been able to go to workshops otherwise because they had commitments. I had a woman from Alaska, she did both the core and then the beyond the core with me, during that five-year period. And she was not going to be able to attend anything, but she was at home and she was able to take the time that we, to be able to do that so

Mark Royce (33:42):

Well, the time and the expense, you know, of doing a face-to-face workshop is, is a challenge that we're

Tom Pfeiffer (33:50):

Yeah.

Mark Royce (33:51):

A lot of the AMTA people are trying to figure that all out. How we, how we can make it work smoother.

Tom Pfeiffer (33:57):

I love going to the in-person workshops. I really liked, I liked traveling to different places. I liked actually meeting people and being able to go out and socialize and Arizona was great. It's so different than Vermont and I liked the desert and there's so much to do there. That was great. But you know, not everybody has that. I happened to be, have a supportive spouse and my kids were old enough to where they didn't need me at home. They weren't like infants, so I was able to go away for a few weeks and they didn't care that I was gone for three weeks.

Mark Royce (34:34):

Yeah. That's awesome. Well, hey, Tom, it has been awesome talking with you, getting to know you, hearing about your experiences and the contributions that you've made. It's awesome to know there are teachers with the passion that you have for the wellbeing of our students and, and their learning journey. So I just wanna say thank you very much for taking the time to spend this little half hour with me. Oh, I appreciate It.

Tom Pfeiffer (35:07):

Well, thank you for having me. I appreciate it.

Mark Royce (35:10):

You take care of yourself.

Tom Pfeiffer (35:11):

Alright.