



Science Modeling Talks

Episode 85 - College, High School and Middle School Modeler

Guest: Christy Jo Geraci

Mark (01:30):

Hi, Christie. How are you today?

CJ (01:33):

Hi, Mark. I'm great. How are you?

Mark (01:34):

I'm good. Can I call you CJ?

CJ (01:36):

Yes. Yes, you may.

Mark (01:37):

Okay. All right. Awesome, awesome. Well, I'm excited to talk to you today about your experiences with the, uh, modeling world. And I read your bio and boy, it was, it's very impressive. I mean, gosh, your background in all those different countries that you've been to, the different agencies that you've worked alongside of, before you landed as I assume you're in, are you high school teaching now?

CJ (02:11):

I'm teaching eighth grade this year.

Mark (02:13):

You're teaching eighth grade.

CJ (02:15):

Yes, but I've taught high school, last year.

Mark (02:17):

Yeah. In the past. But you're bringing this wealth of experience and knowledge to these eighth graders and that's very exciting that you've chosen to do that and invest yourself in children. I think it's great.

CJ (02:30):

It's been wonderful.

Mark (02:32):

I give you kudos for that. So I'm gonna just ask you a couple questions about your experience. And first thing I want to know is what led you to modeling? You know, with all that experience that you've had and you've been all over the world <laugh>, what led you into the modeling world?

CJ (02:51):

Well, first, thank you for having me. I'm really excited to be part of the podcast. I would say there were a few specific instances that led me to modeling, but I think having the career that I did before becoming a teacher made me especially receptive to the kind of instruction and the kind of pedagogy that is modeling instruction because it so much aligns with how scientists learn about the natural world to begin with. The first time I ever heard of modeling instruction was when I returned home from teaching abroad and I wanted to change and pivot into K-12. But I didn't really know much about teaching. I mean, I had taught as a college professor, but, you know, when you're in higher education, your primary goal is research. And teaching, even though it was a passion of mine, it had never been anything I had been formally trained to do.

CJ (03:54):

You know, I learned to teach by being a learner and watching my major professors teach and my committee members teach. So I decided when I came back to the US that I should take some education courses, that that would be a good idea. So I enrolled at the University of Richmond where I was living in Virginia and they had a certificate program specifically geared towards career switchers. And I was taking a course that required me to go, or I shouldn't say required, it let me, it gave me the opportunity to go and visit a whole bunch of different classrooms all around the Richmond, Virginia area. And I went into a chemistry classroom. I think the second semester I was there was in the spring and students were preparing for the AP chemistry exam. And I got to see two classrooms side by side, sort of a natural experiment.

CJ (04:46):

And the first classroom was like many other classrooms I had been in and had varying levels of engagement with the students. And then after that, I went into this second classroom and I saw something that was just amazing. It was a teacher with a tablet, a wireless tablet, and she was using the tablet to write problems on the board. And the students were just waiting for these problems to come up on the board. And they had, they had whiteboards. And I'd never seen that arrangement before. And so the students were really quiet, waiting for the teacher to put a practice AP chemistry question on the board. And then they all just leapt into action. And it felt like chaos for a few seconds. I remember a whiteboard almost hit me in the head because I was standing behind a student who didn't see me.

CJ (05:36):

And I just remember thinking, wow, every single student in this room is engaged. Every single student is working towards answering this question. And there were students visiting from one lab group to the next, trying to see their ideas. And this was encouraged, this wasn't seen as cheating, you know, this was seen as learning because they were all practicing. They were all trying to figure out. It was a problem about ideal gas laws. And from then on, I was hooked and I asked the person who I was with, I said, "What, what is this?" And they said, "This is, this is a modeling classroom." So that's the first time I'd ever seen modeling instruction in, in place. I regret that I don't know who the teacher was. I didn't even get a chance to meet the teacher because we were whisked away shortly after that to the next room.

CJ (06:21):

But I kept that in mind when I moved to Arizona the next year. And when someone at my school offered to fund the teachers going to a chemistry modeling workshop, I said, "I think if it's what I saw in Virginia," I said, "Sign me up. I'm not a chemistry teacher, but I want to go to this chemistry teaching, this chemistry modeling workshop." And that

was in 2017, I believe. Wow. With, with Mitch Sweet and Russ Schaefer at Tempe Prep. And so I've been a modeler, you know, I've been a modeler ever since.

Mark (06:56):

Wow. So you just dove head first right into it. That's awesome. Yes. So, you've been modeling then since '17. Your work with eighth grade is a little, most, I mean a large percentage of the modelers are in high school. You know, employing it in high school, but there's a growing number in middle school and that's where eighth grade falls. Yes. Have you taught modeling practice in high school as well or just in eighth grade?

CJ (07:30):

Yes. I started after I taught college, I taught high school for a year in Virginia and before I knew about modeling. And then when I moved to Arizona, I started working for a K-12 school. So I had two ninth grade biology sections and I had two seventh grade life science sections. And then the next year I moved up to teaching ninth and 10th grade. So I taught ninth grade biology and 10th grade chemistry. And for the next four or five years, I taught exclusively high school, ninth and 10th. And then I taught middle school when I moved to Louisiana. My family moved to Louisiana for a few years. So I taught younger students. I even taught my son's third grade STEAM class for a trimester - Oh wow. At his school and tried some modeling with third graders. So that's the lowest grade that, and we had whiteboards and we did, you know, what, the best I could tell was some modeling instruction for their age group.

CJ (08:38):

And they loved it. They loved it. And then when I returned, when we moved back to Arizona last year, I taught 10th and 11th grade physics and ninth grade biology again. And now I'm, now I'm teaching eighth grade physics because there was a need for someone who had a passion. I'm really passionate about teaching beginners. Even when I taught at the college level, I taught beginners. That's my joy. It's not that I don't like teaching more advanced students. I love that too, but there's something about teaching beginners that just refreshes me and renews me every year. And eighth graders are beginners in their ability to understand complex and abstract ideas. I mean, my eighth graders in my physics class are really thriving so far. And I really love that. And I think that if you talk to a middle school teacher, probably one of the common denominators we have is we love, we love beginners.

Mark (09:42):

Yeah. That's awesome. So I'd never heard of anybody teaching a third grader or, you know, the primary <laugh> grades. That's really cool and really something. You know, I've heard a lot of modelers say that modeling is progressive and it would be awesome to see people teaching in the younger grades as the kids, to prep the kids for what they're gonna be experiencing as they get into high school or even into college, you know, with models and stuff. That's really exciting.

CJ (10:14):

It is, it is possible. It was not easy and, you know, my son was in the class, so I had instant feedback as to how I was doing <laugh>. So I think I had an advantage. But it is possible to model with younger grades if you have their developmental stages in mind and you align it accordingly.

Mark (10:35):

That's really, really cool. So did you see a lot of difference in teaching, or how would you describe the differences in teaching modeling in high school versus middle school and maybe even <laugh> elementary, but especially between high school and middle school. How do you see the differences in how you approach the class?

CJ (10:57):

Well, that's a great question. I think there are two main things that I found are different. One is the curriculum

expectations. And I know this varies from state to state, but in my experience, the middle school curriculum is more broad. You cover more topics, but you don't cover them as deeply. And so your models are different and they may be ordered differently than a high school class which is just in one single domain. So for example, when you teach high school chemistry, there is a progression of models that are all, you know, pretty squarely within the domain of chemistry that are different from the models that are in the domain of physics. In middle school, when you're teaching a physical science course and roughly half the year is dedicated to standards that would fall more in line with chemistry and the other half of the year are standards more in line with physics, and you're also trying to teach students the basics of measurement, then you get to expose them to a broader, but perhaps slightly shallower series of models.

CJ (12:10):

And so there are decisions you have to make about what to cut out and when to move on from one model to the next that you don't have to make as a high school teacher because you don't have to switch back and forth between chemistry content and physics content or between different levels of life science content.

Mark (12:31):

Hmm.

CJ (12:32):

Interesting. And in third grade, because students were still very much learning to be good readers and good writers and good observers, much of what we did would really fall squarely within the whiteboarding, you know, teaching them how to express their ideas on a whiteboard. I don't know that I would say we did any formal models. We were working with Lego kits. They were building, they were using software to build and program autonomous Lego vehicles so that we could race them in the hallways. So much of what I was leading them through was the engineering design process. And even though they were only in third grade, they could, they could go through it and we went through that process. So to what extent the engineering design process would be aligned with modeling, that's what I would say the younger grades really liked.

Mark (13:23):

Yeah. That's very cool.

CJ (13:24):

You build something, you test it, you, you know, inevitably you break it because you're going to crash it in the hallway, you know, a, a physical model and then you revise it.

Mark (13:35):

So you've been teaching in, in several different schools.

CJ (13:39):

Yes. And we have moved physically around a lot in the last decade.

Mark (13:43):

Is that because of your family circumstances?

CJ (13:47):

Part of it, yep. Part of it was job opportunities for my husband and I and for my husband and me and part of it was moving to be closer to family and then realizing we missed the desert and coming back.

Mark (13:57):

Oh, so you're back in Phoenix.

CJ (13:59):

Yes. We are back in Phoenix.

Mark (13:59):

Cool. So in these different schools, were most of them pro-modeling already or were they mixed or were, you know
- It's a, it's

CJ (14:11):

A mix. I've been at schools where they'd never heard of modeling before and I was the first teacher to try it and have had great support for it. I've explained to my bosses what I'm going to do and they said, "We trust you and let us know what you need." And then I've had schools that have, they were more hesitant to adopt it because of the, whatever concerns they may have had that, that it was different from what they were used to.

Mark (14:42):

Interesting.

CJ (14:43):

'Cause modeling is hard. It's, it's much easier to just talk at kids who are sitting in rows from a lecture slide than it is to get them engaged while still maintaining some semblance of order and discipline.

Mark (14:57):

Yeah.

CJ (14:58):

Especially in the younger grades.

Mark (15:00):

Mm-hmm. Tell us a little bit about the approach that you take when you're in a situation where maybe the school is not as open, or perhaps maybe talk to us a little bit about how you approach it when you're well supported. I don't know. Just tell us a little bit about you in the classroom.

CJ (15:19):

Okay. I can speak to the one concern that's been shared with me the most about a hesitancy towards modeling is that students don't have something like a textbook or they don't have a set of slides to learn from on their own. That if they miss the conversation for whatever reason, that they don't know how to recover from what they missed in class. For example, if a student is absent or if a student, just, you know, for whatever reason, they were having an off day that day and the whiteboard conversation didn't help them. You know, kids have good days and they have off days. What will they do to learn the material? They feel like. I've had parents express to me that, you know, students don't, they bring home nothing. And so they don't know how to help them at home.

CJ (16:10):

They don't know how to help them study. So I've been more direct about creating resources that students can use if they miss classroom instruction or if they need more practice after the classroom instruction. I've incorporated

some textbooks into my courses, some free online textbooks. I've used resources, like there's a resource called the physics classroom. That's a free resource that you can use online. OpenStax textbooks is what I've used in the past for both chemistry and biology. So that's one thing I've done is try to give them resources, a broad variety of resources that they could access outside of the modeling classroom if they need more practice. And that has seemed to give students the confidence then to open up and try new things in the modeling classroom because I think they're less afraid that if they, if their board presentation doesn't go well or if they don't understand a particular problem, that that's not, that it's not the end.

CJ (17:11):

That doesn't mean they're gonna fail the test.

Mark (17:13):

Right.

CJ (17:14):

Of course, I never think that they're gonna fail the test just because one board meeting goes south. You know, modeling instructors are used to that. We're used to going back and being iterative, right? That's one of the joys of modeling is that you always get to go back. But I don't know that the kids and the parents understand that right away. They need to, they need to be reminded of the fact that we don't just cover material and move on because perhaps that's what they're used to in the past, you know, that we covered this unit and I missed a week of it because I had the flu or I had to go out of town. And so now we've moved on to the next topic and what am I gonna do to catch up?

Mark (17:51):

Yeah. So when you say you're using these other textbooks from other sources than the AMTA resources-- Are you just gleaning this a bit and piece from here and there in the book to help support the curriculum that you're following with the modeling pathway?

CJ (18:12):

Yeah, I'd say that's fair. I also will post links on the school website, whether it's, you know, one school used Google Classroom, my school's using a different site now. I will put them as links for extra practice - Yeah. Or extra help. Yeah. And I usually do it on a weekly basis that if we're, if right now we're doing, working with acceleration models in physics, and so I will look at whatever part of that online textbook or online tutorial explains acceleration in a different way. And I'll post that as a link that if you missed a day or if you need extra help or you are just a student who likes to read as part of your instruction, here's where you can go. And I don't require them to do it, but I've had students tell me that it's helpful to have those extra resources linked in a way that they can, they can use them asynchronously - Right.

CJ (19:10):

And in their own time. Yeah.

Mark (19:11):

That's really cool.

CJ (19:14):

AMTA has videos too that can be used for that purpose. I would love to see more of those. I know it's hard to make them though. <laugh>

Mark (19:24):

Well, it takes time and technology and, you know, a little skill for editing and that kind of thing, so.

CJ (19:33):

They're especially helpful for labs. And that would be the other thing that I would say is very different about trying to teach younger students from older students is the level of autonomy versus supervision that you have to give them. And since every unit that we do is grounded in as much laboratory and empirical data collection as we can, right, that experience is key to building the model. And because we start with the lab in modeling instruction versus doing the lab at the end to confirm what we learned in the textbook, if a student misses a lab or if something in the lab doesn't go right, then they can feel left out throughout the rest of the process. So having a video of the lab or having an interactive lab or a virtual lab for them to go to if they were absent or if their group's data didn't work, that's really helpful.

CJ (20:27):

But then the level of supervision you need to give them is greatly different. You know, I can't give sixth, seventh, and eighth graders open access to lab equipment and walk over to the other end of the room and just hope and pray it goes well. You might be able to do that with a 11th or 12th grade physics class. But with middle schoolers, you have to have a lot of routines. So I build in very specific roles and very specific routines and habits and I guide them, hopefully that's my goal is to guide them towards more and more autonomy by the end of the year so that in fourth quarter, I can put a lab set up in front of them with a set of instructions and expect that they will be able to do it safely and without, you know, without breaking things because equipment is expensive.

Mark (21:14):

Yeah. It sounds like, it reminds me of what my wife has said to me many times is that she sees her role as teaching students how to learn. And I think that's wonderful and a very powerful part of what the modeling approach is all about. And it sounds like you're doing that <laugh> and, and it's pretty exciting to meet people like you.

CJ (21:39):

I think back often to my coaches throughout the years. I played sports a lot when I was a kid. I was a soccer player even through college and our coaches would teach us any number of skills from how to kick a ball to the specifics of how you need to kick a ball if you need it to go in the air versus if you need it to go on the ground. And when you're teaching little kids, when you're coaching little kids, you're teaching them skills. And when you're coaching older kids, you're putting them on the field and expecting them to show you the skills that they learned years ago. And the type of coach that can lead a high school soccer team is going to have to have a different personality and a different level of trust in the players than a peewee soccer coach.

CJ (22:28):

Right. And the middle school coaches are, you know, we get a little mix of everything. <laugh> It's, it's, middle school is fun, but it can be stressful too because you have kids who are really further, you know, really far along in their development of their skills, whether it's intellectual or physical skills. They're a lot bigger. You know, you've got kids in eighth grade who are really tall and high school size already, and then you have kids who haven't hit their growth spurt yet. So physically, they're really very quite different from each other. And that is important on the soccer field, but it's also important in a chemistry lab.

Mark (22:59):

That's awesome. So, you mentioned, in some stuff I read about you that you're curious about the social dynamics between chemistry, physics and biology modelers and teachers. And you know, about collaboration between the different disciplines. Talk to me and your fellow teachers and the listeners who are considering modeling and look-

ing at, tell us kind of where you're at with all that.

CJ (23:28):

So I started my career as a biologist and an ecologist, that's where my background is. And when I switched to high school from college, I thought that I would teach biology, right? There were so many different kinds of biology to teach. It wasn't a consideration that I would move into teaching chemistry or physics. I don't think I realized then just the need for chemistry and physics teachers. I think about, you know, a decade ago when I started teaching high school was when there was a large wave of retiring chemistry and physics teachers and not as many filling in behind, at least where I was. So I started off teaching the courses for which the content I had a graduate degrees in. You know, I had a lot, very depth of knowledge, a great depth of knowledge in biology content.

CJ (24:21):

So I could think on my feet very quickly because I had studied that domain for a long time. But when the first time I taught a high school chemistry course, that was more terrifying because I had not had chemistry since I was an undergraduate, not formally. You know, of course I used some chemistry in my research, but I had not done those sorts of chemistry problems in a long time. So there was a fear, you know, constantly in the back of my mind that a student would ask a question and I wouldn't know how to answer it. And I think teachers who switch domains have that fear, whether you're going from chemistry to biology or biology to physics or physics to bio, however you're changing, there's a fear that you're expected to be, what do they call it? The sage on the stage.

CJ (25:10):

And that, you know, if you're not, if, if you're a sage in one area, but you haven't done the other area since you were in college, that you're gonna look silly up there. And there have been times where I've made mistakes and there have been times where I have to admit, you know, this isn't my primary field. That's a really good question. Let's talk about it again later. I don't have an answer right now. So you have to have a lot of humility to switch. And I also had to do a lot of learning on my own to reteach myself the fundamentals of chemistry and to reteach myself the fundamentals of physics because after I taught chemistry for a few years, then I was approached to say, well, would you teach beginning physics? And my answer was always yes.

CJ (25:51):

There was a, well, there was a Ted, I love Ted Lasso. So we've been watching the new episodes of Ted Lasso. And the one from this week was the assistant coach was learning from Ted, what they learned in their improv class and it was "yes, and." So I think that's, maybe that's been my motto and I haven't realized it, that I, I'll say yes, and, like, yes, I'll teach physics and I need to go to a physics workshop because you can't put me in front of eighth graders, ninth graders, 12th graders, third graders until I've taken the AMTA physics workshop. You know, yes, I will teach chemistry and I need guidance. I need a chemistry modeler who's been doing this for 10 years on speed dial so I can ask them what happens when the lab goes wrong.

CJ (26:35):

So I think that's where the collaboration comes in. If we can recognize that at any point, a school could have a need for a science teacher to teach outside of their narrow domain, if they want to do it and they can say yes and, and the and is the AMTA community, then they're gonna succeed. Mm-hmm. <affirmative>. If it's yes and I'm by myself, then they're, they may not succeed.

Mark (27:00):

Right. Are you finding that the AMTA, and for those who may not know who are listening, American Modeling Teachers Association, are you finding that there is a good sense of community and collaboration there and available help?

CJ (27:18):

Oh, yes. I would not have ventured outside of my comfort zone in biology if I didn't have the community and the collaboration. I always have someone who's willing to help me. It's anything from last year I was trying to do a lab with a piece of equipment and a piece of software and I couldn't get it to work and I didn't know what was going wrong. And this was the main lab that was the anchor of the model in the class I was teaching. So I took some pictures of my setup and I sent it off to the group chat that I was on with a bunch of physics teachers. And I got so much help instantly that within a day, not only had I figured out how to set up the equipment, but then I was able to go teach the AP physics teacher how to get his setup to work correctly because we realized we both had the same issue.

CJ (28:08):

Hmm. There was a button we weren't pushing. And so I was able to then help the teacher who had been teaching physics for 20 years. And that made me feel great. Because I haven't been teaching physics for 20 years and I'm not a physicist, but I got the computer to recognize the probe wear. So little things from that, from that to how, you know, how do you handle it when you are standing in front of a group that back to school night and you have to admit, you know, yeah, I'm teaching your kids physics, but I'm not a physicist. How do you communicate confidence to them that you are still the best person to be standing in front of their kids? And that you care about them and they are going to learn with you and they are going to thrive with you because maybe your degree isn't in the science field that you're teaching, but you are still a scientist, you are still grounded in scientific principles and you have been well trained by modeling workshops.

Mark (29:02):

That's awesome.

CJ (29:03):

And that's been really helpful. Yeah. Again, I would not be, I would still be teaching biology and not have adventured, ventured into chemistry and physics without collaboration.

Mark (29:12):

Yeah. You mentioned chat, the chat group that you were connected with that helped you with that one problem. What are the vehicles that you're finding most useful? And maybe talk about what you'd like to see evolve in the AMTA offerings.

CJ (29:27):

I would say anything that enables personal connections. Whether that's, it could be any means. It could be just a text message or I could call--I have, uh, folks who I could call and FaceTime if I needed to show them a lab setup. Those sort of informal, impromptu problem solving sessions. I also have been part of webinars. I've been part of formal planned collaborations where you can see folks face to face. And the summer workshops that I've been to in Phoenix have been the most helpful because you are there with these folks all day, every day for a number of weeks and the bonds that you can form with them, they last. They last forever. And then it's - Yeah. Then it's just a matter of what technology you're going to use when you need to ask them for advice or when they need to ask you for advice.

Mark (30:27):

Well, Christie, is, is there anything that you would love to share with the AMTA and other modelers in your community or those who are listening? Is there anything that you'd love to just share with them about your desires about how you would love to see AMTA evolve?

CJ (30:50):

I would love insight from experienced modelers for how to keep students engaged when they feel uncomfortable. There was a great paper that I read out of the Harvard Physics Department where they surveyed physics majors about how they felt about their learning, and then they actually measured their learning. And even Harvard physics students didn't feel like they were learning in the more active classroom. I don't know that it would fit formal modeling, but it was more active learning instead of passive learning. And modeling instruction is such an active learning style. So I would love to have more conversations and advice and maybe even some materials that we could share with students, with parents, with administrators of how do we kind of walk alongside students who are uncomfortable at being uncomfortable and want more of a passive learning experience, to build them up, to teach them resiliency.

CJ (31:53):

And I've gotten some great input from different teachers within the modeling community at different times, but I would love to see that be a focus. I think it would help a lot of us who are engaged with some hesitancy towards modeling.

Mark (32:10):

Yeah. That's kind of a, a classroom management issue a little bit, you know, about how do we deal with in the classroom with those kids. That's a really, I think that's a very insightful, concern.

CJ (32:23):

I think that it could be something that is an ongoing conversation. You know, I, I'd love to have some formal or informal venue, perhaps at an upcoming conference where we just, we share our experiences where we had a student who was hesitant or a parent who was hesitant and we share how we reacted and how it went.

Mark (32:44):

I know that Caroline, who is the president now of the AMTA is working toward a revamped website and elevating, if you will, the existing website. And maybe that's the kind of content that could be included.

CJ (33:04):

Oh, that would be lovely.

Mark (33:05):

You know, she's very open to communication, so.

CJ (33:10):

And I'm very excited about the new website. I've seen some sneak peaks and it's looking really good so far.

Mark (33:16):

Oh, good.

CJ (33:17):

I'm excited to use it.

Mark (33:17):

I'm glad to hear that. Well, our time's about out. Is there anything else you wanted to say before we say goodbye?

CJ (33:27):

Just thank you for having me. This has been really interesting and it's an honor to get to talk to the modeling community. And if any of the folks who are listening want to chat about teaching younger kids in modeling instruction, I would love to talk to them.

Mark (33:46):

Do you wanna share your email or something, a way they can get ahold? I know you have a modeling instruction email, I think, right?

CJ (33:54):

I do. Okay. It is CGeraci, so C-G-E-R-A-C-I at modelinginstruction.org.

Mark (34:07):

Cgeraci@modelinginstruction.org. Correct. Geraci is G-E-R-A-C-I. Yes. Cool. That's awesome. Thanks for sharing that. And we'll post it on the website as well at sciencemodelingtalks.com. Well, it has been a real pleasure to talk with you, Christie, CJ. You are a fascinating person and I'm excited that our students are being exposed to you as a teacher.

CJ (34:36):

Oh, thank you. I've, I've had fascinating teachers who've taught me well.

Mark (34:39):

You're obviously bringing a lot to the table and, and that you're exactly the kind of teacher we need a lot more of. And so thanks for sharing your insights and maybe we'll talk again one of these days.

CJ (34:53):

Okay. I'd like that.

Mark (34:54):

Yeah. Thanks for doing this.

CJ (34:55):

Thank you, Mark.

Mark (34:56):

Uh-huh. Bye.

CJ (34:57):

Bye.