

Mark Royce (00:00):

Hi, Deanna. How are you?

Deanna Cullen (00:03):

Hi, Mark. I'm great. It's nice to see you.

Mark Royce (00:06):

You too. I'm really looking forward to our conversation today. I know you are an adjunct at the university. Are you using modeling in your classes in the university?

Deanna Cullen (00:21):

No, I teach a lab and the curriculum is pretty set, so I don't have that opportunity. But I did teach high school, where I did use modeling. I'm retired from the high school classroom.

Mark Royce (00:33):

I see. Yeah. That was in like 2016, 2017, somewhere in there?

Deanna Cullen (00:38):

I did my modeling workshop in the summer of 2014, so I had a few years of practice using modeling instruction in my classes.

Mark Royce (00:50):

That's cool. So how were you first introduced to the concepts of modeling instruction? When did that happen?

Deanna Cullen (00:57):

Well, I actually did a target inquiry program at Grand Valley State University, 2008 through 2010. And I didn't realize it at the time, but a lot of the concepts, strategies that we learned in that program, I knew they came from Arizona State University, some of them, but I didn't realize how much those ideas were directly related to what was being taught in modeling instruction. And so when I had the opportunity to take the training in 2014, I realized just how much of the information I already had. There was a lot that I had not seen yet. I was not familiar with the course order, or the way the units were structured. It was an easy sell for me in terms of inquiry. And I was really excited about it right away. But that modeling workshop was overwhelming in a way. There was so much great material.

Mark Royce (02:23):

Yeah.

Deanna Cullen (02:23):

So it was exciting to try it out in the classroom.

Mark Royce (02:26):

So you took the workshop in 2014. When did you first hear about modeling, though? I mean, had you heard about it because of your work with the journal?

Deanna Cullen ([02:36](#)):

I think the first time I heard about it was from Erica Posthuma at a conference. And I thought I knew what she was talking about, but modeling instruction is so much more than what my vision of what modeling was.

Mark Royce ([02:57](#)):

Huh.

Deanna Cullen ([02:57](#)):

So it was through her that I've got that introduction and she actually was a lead contributor at the time for ChemEdX and is now an associate editor for us. And she wrote some posts about modeling instruction. So I learned a lot working with her.

Mark Royce ([03:19](#)):

She's awesome. I've had connections with her through the AMTA and even she's helped me with this podcast a bit too in the past. So she's been a really great person to know. So let's back up. Tell me a little bit about your work with the Journal of Chemical Education and also with the Chemical Education Exchange. Talk to me about your work with those entities.

Deanna Cullen ([03:48](#)):

Sure. So in 2012, I became an associate editor for J ChemEd for High School, along with Greg Rushton. The two of us worked together, and right away he focused mostly on the editorial work that was typical for J ChemEd. And I worked with John Holmes, the managing editor on the materials that J ChemEd didn't plan to host anymore and support online. Primarily those were resources for high school teachers.

Deanna Cullen ([04:30](#)):

John put together a website called Chemical Education Exchange that now hosts those materials and resources, and we continue to upload new content as we go. And so, I'm the high school editor. We're primarily focused on serving high school teachers that have typically been underserved. And now in the last few years, we've had a two-year college editor as well.

Mark Royce ([05:05](#)):

Help me understand a little, I wanna be clear on this, the differences between the Journal of Chemical Education and the Chem Ed Exchange. Help me understand their roles.

Deanna Cullen ([05:22](#)):

So, J ChemEd is a print journal. You can also find it online. Much of it is research based. Most of it is written by professors and ChemED researchers. There are some high school authors, and they have historically done what they could to support high school teachers in other ways by providing some online resources. And when ACS Publications and J ChemEd made a joint publication agreement, the decision was made not to host the online resources that they had previously. So we host those at ChemEdX. Both J ChemEd and ChemEdX are overseen by the board of Publication of the Division of Chemical Education. So we're overseen by the same board, but JChemEd is a separate platform from us, and we host mostly blogs, in terms of newer content. And the bar for publication is not as rigorous as it is for J ChemED.

Mark Royce ([07:02](#)):

So, would I be right in saying that J ChemEd is more to learn about research and read articles and that kind of thing? And, and the exchange is more about where resources are hosted and people can go to find if they want to do a deeper dive. Is that kind of how they work together?

Deanna Cullen ([07:24](#)):

J ChemEd is full of articles that are published primarily by college professors. They do share resources in terms of labs and demos, but much of it is dissemination of their research. Where ChemEdX teachers might blog about ideas that they have for things they wanna try out in their classroom. They might share an activity they've used before, but they haven't done research on it.

Mark Royce ([08:03](#)):

Okay.

Deanna Cullen ([08:04](#)):

They, it might be based on research that they know about, but they haven't done research about the activity itself, necessarily. One of the posts that gets a lot of views during modeling instruction courses is one that Erica Posthuma posted about build-a-boat and developing culture in your classroom at the beginning of the year. It goes through the activity and it provides video to support the teacher in using it.

Mark Royce ([08:51](#)):

So if I go to ChemEd Exchange and just search Erica Posthuma

Deanna Cullen ([08:59](#)):

If you search for Build A boat, you'll find you'll find her post.

Mark Royce ([09:05](#)):

So are you guys, do you have certain people that you receive contributions from? Or are you looking for contributors, or how does that all work? Say there's a teacher who's listening to our podcast today and they have something that they're really excited about, that they'd love to share, how do they go about doing that?

Deanna Cullen ([09:27](#)):

So we have a team of lead contributors and associate editors that contribute on a fairly regular basis, but we also have outside authors and we are always happy to accept submissions from outside authors that have something to share. There's a contribute button on the homepage of ChemEdX that will give a potential author the information. And if they just want to ask questions about the possibility of us publishing on a certain topic, they can reach out through the contact us button. Those emails come directly to me and I'm happy to talk to potential authors and support them. I'm happy to receive a rough draft as well.

Mark Royce ([10:23](#)):

So if you're a listener and you've got something really cool going on in your classroom that you wanna share, this would be a good place to do it. So that's really exciting.

Deanna Cullen ([10:32](#)):

Absolutely.

Mark Royce ([10:33](#)):

Cool. I know that through the years, not just with J Chem and Chem Ed Exchange, you've worked with a lot of other educators at a lot of different levels through the years here, because as a teacher, I know you were involved in influencing other teachers and that kind of thing. Tell us a little bit about the focus that you've had through the years with working with others. And this is a very broad question, I understand, but maybe some high points for you. Some things that you've discovered, learned working with others. Anything stick out for you?

Deanna Cullen ([11:14](#)):

So one of the favorite things about the role that I serve now is just having the opportunity to meet so many different types of educators at different levels. And just sharing passion for teaching is always exciting to me and inspiring and keeps me going.

Mark Royce ([11:34](#)):

Yeah.

Deanna Cullen ([11:34](#)):

Even though I'm editor for ChemEdX, I still adjunct just to stay in the classroom. 'cause I enjoy being with students and teaching. That gives me my fill there. But, connecting with other educators is just a different type of activity that I enjoy. For most of my career I was the only chemistry teacher in a small district, and I didn't have anyone else to go to.

Mark Royce ([12:11](#)):

Huh.

Deanna Cullen ([12:12](#)):

And so the idea of working with other chemistry teachers was always very appealing to me. And my work with Target Inquiry with Grand Valley was pretty instrumental in changing my career trajectory because I got to work with so many other educators and learn from them. We're so much better when we learn from each other and support each other. It wasn't long after working with Target inquiry that I had the opportunity to work with JChemEd and ChemEdX and learn about modeling instruction and meet a lot of teachers there. Which, I'd have to say, modeling instruction teachers are some of the most passionate teachers that I have worked with.

Mark Royce ([13:10](#)):

Yeah.

Deanna Cullen ([13:11](#)):

They have a great community.

Mark Royce ([13:15](#)):

Very true. I'm not a teacher. My wife is. She's a AMTA modeler and she's very passionate about her work too. Hey, uh, you just mentioned target inquiry. You, you said your exposure to-- I had not heard that term before. I kind of can guess what it is, but can you tell me a little bit about what Target inquiry is, your work with? I know you're involved with it at the university at Grand Valley State, but tell me more about it. What is the Target Inquiry program and what is your work there?

Deanna Cullen ([13:58](#)):

So Ellen Yeziarski and Debbie Herrington started Target Inquiry with a large grant, and it was designed to help teachers use inquiry strategies in their classrooms. It was a long-term professional development program. It was two and a half years from beginning to end. And each of us did research with a professor at Grand Valley that was not based on education. So I did mine on antibiotic resistant bacteria. So I was immersed in a little bit of research and did a paper and submitted my work as an oral poster to a regional ACS meeting. And then, after learning some inquiry methods, each of us wrote two labs using inquiry and focusing on misconceptions that students would have on whatever topic we were focusing on. And incorporating some of the ideas that are used in modeling instruction, including Johnston's Triangle, looking at different representations, student discourse, and having students have an initial experience that we could refer back to as we built on the topic.

Deanna Cullen ([15:55](#)):

So I wrote one of mine on Electrochemistry, and the other was on the periodic table. And I've used a lot of the labs that came out of that. They're really great. And they're still available on the Target inquiry website. So we all did research on those. We tried them out on each other. So I was the teacher and all of the other teachers acted as students the first time through. So then they gave input and we just helped edit each other's labs and learned as we went. And so it was so much easier when we got to go into our own classrooms and use those activities.

Mark Royce ([16:49](#)):

Inquiry is such an important part of modeling instruction, too. And so is there some kind of like overlap between Target Inquiry and modeling approach?

Deanna Cullen ([17:04](#)):

Absolutely. A lot of the things that we learned came from research from Arizona State, which is the same place where modeling instruction was founded. So absolutely a lot of different overlaps. And so it was not a hard sell when I took the modeling instruction training in terms of using inquiry. We went through activities trying to get the attendees to buy into using inquiry, and that part of it was an easy sell for me.

Mark Royce ([17:43](#)):

That's cool. Tell me a little bit about after you took the modeling workshop, you said it was kind of almost overwhelming at points. How did it change your approach in the classroom? What would be the key point that you would say it really modified your thinking about your approach in the classroom?

Deanna Cullen ([18:07](#)):

So I was already using kind of activities early to build instruction upon so that all the students had a common experience. And that happens a lot in modeling instruction. And I was already using a lot of discourse. I wasn't using whiteboards before modeling instruction, but we often used large pieces of

paper, or we wrote on my desks, things like that. So it was pretty similar. Like I said, we were already using Johnston's Triangle type representations, but the big difference for me was the order of the topics. And I was a little worried about it initially because I had done a lot of skimming of certain topics that modeling instruction spends a great deal of time on in the beginning of the year. And I was worried that I wasn't gonna have time to get to some of the things that I needed to prepare students for AP chem.

Deanna Cullen ([19:25](#)):

But I was pleasantly surprised. First semester seemed like it took way too long, but second semester was a breeze because we had that strong basis. And students learned how to evaluate data and they knew the program. So things went more smoothly second semester because they took on a lot of more of the learning for themselves. And one of the controversies about using inquiry is that we want students just to figure it out themselves. And that is not the case. We're teaching them how to do science and then they get to practice doing science and they learn as they go. It doesn't mean the teacher isn't really directing them and helping them figure things out. And the BCA tables made a huge difference in my classroom, energy bar charts made a huge difference. They seem so much more intuitive to me. I wish that I had learned them sooner because I felt like my students really benefited from those.

Mark Royce ([20:53](#)):

You used the term Johnston's triangle.

Deanna Cullen ([20:57](#)):

Yes.

Mark Royce ([20:58](#)):

Many of my listeners probably know what that is, but I don't. So can you...

Deanna Cullen ([21:04](#)):

So Johnson's Triangle, we look at the macroscopic, the particulate level, and the symbolic level. So we might have an equation that just so shows something as simple as changing water from liquid to gas.  $H_2O$  liquid yields  $H_2O$  gas when you add heat. And you might have a picture of a boiling beaker of water as the macroscopic, and the particulate level, we would draw the particles of the molecules of water in the beaker, while it's liquid, and then what it looks like when it's a gas. And there's a lot of misconceptions there because students might think that the hydrogens and the oxygen separate apart from each other, which is not what happens, of course. Some students might think that the molecules get bigger, but they don't. They just spread apart more. So it's a valuable way to look at things and help find misconceptions. When you ask students to draw those particle models, you can learn a lot about what their thinking is.

Mark Royce ([22:34](#)):

In the work that you do. You're exposed to a lot of research information, especially around educational development. And so what have you learned about professional development opportunities in America for teachers? What, what are things that you're discovering and that you would, from your experience, be able to share with teachers about what they need to know about professional development?

Deanna Cullen ([23:02](#)):

Well, as you know, the modeling instruction courses, they prefer that they're three weeks long and there's a reason for that. The teacher needs to be embedded and have time to reflect and practice and see the instructor model for them what they should be doing in the classroom. And the Target Inquiry program that I did, it was two and a half years long, and the professors were doing research on us and how much we learned through that whole process. And their research showed that having extended time like we did, really helped us to improve our teaching. And we actually tested our students using the ACS exams, high school chemistry exam. And they showed that our students improved over time, through that process, and they continued to test our students a couple years after we finished the program as well. So, I don't know that they have done that type of testing, research through AMTA. I know that they have surveyed the teachers before and after their training. And they do have a concept inventory, I believe too.

Mark Royce ([24:49](#)):

Yeah.

Deanna Cullen ([24:50](#)):

So I end up hearing a lot about different professional development opportunities at conferences. And I'm always interested in the fact that the research that came out of the Arizona State University that relates to modeling instruction is very often included in the professional development opportunities that are offered. So a lot of the people that are doing ChemED research and promoting their own professional development are using the same concepts that modeling instruction are. That tells me that people are trusting it.

Mark Royce ([25:45](#)):

I know that Chem Ed has, is it an annual conference that Chem Ed hosts? Or is it, every other?

Deanna Cullen ([25:55](#)):

There are two conferences that I go to. One is ChemED and I went to ChemED 2023 this past year at University of Guelph in Ontario. And, there will be another one in Golden Colorado in 2025.

Mark Royce ([26:16](#)):

Okay.

Deanna Cullen ([26:16](#)):

This upcoming summer, I'll attend the Biennial Conference on Chemical Education in Lexington, Kentucky,

Mark Royce ([26:28](#)):

The BCCE.

Deanna Cullen ([26:29](#)):

Both of those conferences are the best PD conference that you can attend for a chemistry teacher.

Mark Royce ([26:43](#)):

Oh, awesome. Okay. So 2025 is the next Chem Ed conference?

Deanna Cullen ([26:51](#)):

Yes.

Mark Royce ([26:51](#)):

Okay. And you're going, are you involved in any other way with the conference? Are you teaching or doing anything?

Deanna Cullen ([27:00](#)):

Well, as part of ChemEdX, I'm pretty involved. We give symposiums and we have a booth. But I'm also going to be the program chair of ChemED 2025. So I will be very busy at that conference.

Mark Royce ([27:18](#)):

Okay. So you're helping develop the program and bring in all your contributors and all that kind stuff? Cool. Very cool. Okay. So why don't you give people a reason, tell 'em why they should be there?

Deanna Cullen ([27:35](#)):

Well, for high school chemistry teachers, I always kind of think of it as like summer camp for chemistry teachers. It's very comfortable. The first one I went to, I did end up knowing some people, but I went by myself and met people immediately that I became friends with. And you grow your network, there's lots of opportunities to socialize and there are many different sessions you can go to. So if you're interested in modeling instruction, there are lots of sessions that will be offered and there's usually some modeling instruction workshops available as well. But you can find them for just about any other topic a chemistry teacher would be interested as well.

Mark Royce ([28:31](#)):

That's awesome. Deanna, before we go, let me ask you just what would be the one thing that you would say the modeling workshop did for you in your understanding as a teacher? Tell me about the big point that the workshop got through to you.

Deanna Cullen ([28:49](#)):

So the, the overall picture for me was that we teach students to be scientists. Scientists make observations, they analyze data and they form conclusions. And we know that scientists make further observations that will cause them to reanalyze and reformulate a conclusion. And that's what our students do in modeling instruction. So they're learning to be a scientist. There's built-in review for assessments because we're constantly revisiting old information and prior knowledge and to help students build on that prior knowledge and students revise their model of what is happening in chemistry or in the topics that they're covering, constantly, just like a real scientist does. On a bigger scale. So that for me is probably the big selling point.

Mark Royce ([30:08](#)):

Yeah. Cool. Well, it's been a joy talking with you and it's been very interesting. I know our listeners are gonna enjoy, especially hearing your insights on the Journal of Chemical Education and the exchange online that you're the editor for. And I want to thank you very much for taking the time outta your very busy schedule, to spend this time with us. I appreciate it very much, Deanna.



Deanna Cullen ([30:38](#)):

Thanks Mark. It was good to talk to you.

Mark Royce ([30:40](#)):

Yeah. So we'll see you around.

Deanna Cullen ([30:43](#)):

Alright, thanks.

Mark Royce ([30:44](#)):

Okay, thanks. Bye.