



Science Modeling Talks

Episode 61 - "His Modeling Approach and Where He's Leading the AMTA"

Guest: Ray Howanski

Mark Royce (02:20):

Hello, Ray. How's it going, man?

Ray Howanski (02:22):

It's going well, Mark. How are you?

Mark Royce (02:24):

I'm doing quite well, thank you very much. So, Ray, before you got involved in the leadership at the AMTA, you were a teacher for 35 years or so, for quite a while, in the classroom. When was it exactly that you discovered modeling?

Ray Howanski (02:45):

That's a great question, Mark. I was actually in the classroom for 22 years. Then I switched over to administration for the last 13, to support teachers. I had been teaching from 1988 to 2005 before I ever heard about modeling instruction. That was the year we sent some physics folks to ASU. They came back from a workshop trained in modeling instruction in physics. Had a conversation with Jess Dykes. And he shared with me what they were doing. What was it about? I visited his classroom several times and I just thought it was the coolest thing that I had ever seen in terms of science instruction. It's really what I had been looking for. I said it's a shame they don't have this in chemistry. And he said, well, you would say that.

Ray Howanski (03:52):

He said, they are developing that as we speak. So a colleague and I went onto the website and got the teacher notes and we tried it going around. And that was interesting. Diane Welsh and I went through and supported each other through the first year and checked in with the physics folks. Kind of big picture questions about modeling. We had some successes, some failures. But overall we really liked it. We really liked the approach and we knew that we needed more, we needed more professional development. We needed help. So, I had just become the department chair. So talked to my fellow chemistry teachers and we were able to get a grant through Boeing. Boeing supported us going to get more professional development in modeling instruction. So with all the chemistry teachers, we went out and we had three weeks at ASU. And I have to say to this day, it completely transformed science education for our department.

Mark Royce (05:25):

So when you were actually practicing modeling instruction in the classroom, can you tell us a little bit about the approach that you took in the classroom and maybe, you know, some of your teaching tips that you learned as you did it? 'cause you did it for several years.

Ray Howanski (05:43):

If I can, I'll say a couple things. First, there was one of the transformations I had made prior to learning about modeling instruction was I was committed to listening to kids and listening to students. I was committed to listening to their feedback and to learning what their thinking was. And quite frankly, what I didn't realize at the time is I didn't have all the tools to do that. Okay? So, I actually freed some time up in my classroom each day to do that and have some of these conversations. But when I learned about modeling instruction and I learned more about how to hold a classroom discourse, how to manage that, and how to have students represent their thinking on whiteboards using multiple representations, made all the difference.

Ray Howanski (06:49):

It made that time so much more efficient and valuable. The one thing I'd say that I'd really emphasize and where I think is really impactful about modeling instruction is the listening. Is the learning where the student thinking is. Because as a teacher, I think you kind of learn that if you don't start there, you're not gonna get anywhere. You're building on a foundation of sand and it's all gonna crumble, right? So the students may give you what they think you want to hear. They may give you what they think is the right answer playing the good student role, but it doesn't really change their thinking. You get them to really express how they're processing this information and what they really think is happening. And when you get them to commit to that, and you get that put on a whiteboard and you have a discussion about it, and you help them revise that thinking to be more consistent with what the evidence shows, and they see that, that really does change their thinking, right?

Ray Howanski (08:06):

It changes their approach and for that particular subject, whatever you're looking at, whether it's physics, chemistry, biology, and whether you're looking at velocity or behavior of gases or protein formation, whatever it is you're looking at, it changes the thinking about that. But even on a broader picture, I think it changes their approach to the world in that they realize that they can revise their thinking based on evidence, that they can listen to each other. That they can look at the evidence, listen to each other, and they can come up with a more reasoned explanation for something or a better description of what's happening. And that, I think in the big picture, is really, you know, what we want all students leaving that classroom with. Some of these kids are gonna go out and be chemists and physicists and biologists, but they're all gonna be citizens, right?

Ray Howanski (09:08):

And man, if we can have them thinking like scientists and understand how science works. The other part that I really emphasized in my class was that, when you go through the modeling cycle, you really, in a way, you have a microcosm of the scientific community in your classroom because you're collecting evidence. You have a community of learners. So when the students are all figuring out whatever it is they're looking at whatever event they're investigating, it's the evidence that speaks. It's the data that speaks. Try to take the emphasis off of the instructor and take the emphasis off of an authority determining what's right or wrong, and let the evidence speak. I think that's really important in a modeling classroom. And one of the things that really shifted the focus for me. I really had tried, phrase has been around a long time being a "guide on the side," not a "sage on a stage," but how do you actually do that?

Ray Howanski (10:25):

How do you have that be upfront and obvious to the students? Well, if you keep saying, well, what does the evidence say? You know, what does the data say? They get the idea that that's where they're going to go. And when you stop giving them answers, you keep pointing them back to evidence and data and have them work together to make sense of that, it becomes real for them. That transformation becomes real for the students. So they go through and it's evidence-based, but then also, they get together in these little groups and they're trying to figure out what's happening, and they come up with a representation. They present, which is kind of like publishing, right? I mean, not the full blown publishing, but they're kind of like publishing, right? They're putting up what they think

and they're presenting it to the classroom, right?

Ray Howanski (11:14):

They're gonna put it out there, you know, to their little world. And they're gonna defend it. Other people are gonna challenge it. Well, that's what scientists do, right? And they have to make decisions. You know, does this model that we've created, is it, is it adequately describing what we're looking at? Does it explain what we're looking at? You know, is this piece of data, is that explainable error? Or do I need to change my model? So these are things that scientists are doing all the time, but still the same idea. And then at the end of this process, they all get together, they share their information. They go back and forth and they do reach a consensus. As a class, they go, okay, this is our consensus.

Ray Howanski (12:01):

This is where we are now. This is what we're thinking is a pretty good explanation or description of what we're looking at. And then they get challenged with another set of information, another experiment. And then they have to go back and examine what they were thinking before. So now those students are getting the idea that science isn't about getting the right answer. This is a way of knowing. And the reason that that information is changing all the time is because we learn more, right? We have more information, and therefore, we're able to give better explanations and better descriptions so they really get a good picture of how science works. And I think that was something that we had a discussion about regularly. After each unit we would look back and look at this whole process and say, where are we now? And, what was that process that got us there? Because that the process is really important.

Mark Royce (13:03):

Yeah, it is. So as the XO at AMTA, you guys are aware of what's happening with modeling instruction around the world. Tell us about what you and the AMTA team are learning about the effectiveness of modeling instruction. I mean, it's been around now for quite a while, since Hestones first started bringing it to the forefront. But what do we know about the effectiveness of modeling instruction?

Ray Howanski (13:38):

Well, it's pretty clear that with sufficient training in modeling instruction that, on conceptual inventories, teachers can really improve the results that their students show. That's really important, right? That there is lots and growing data that show that exposure to modeling instruction increases conceptual learning. Teachers, when they go to a workshop, also improve their conceptual understanding. And that shows on the inventories as well. We all know a lot, but we can always get better. And the other part to that is the method of delivering modeling instruction. The method of creating a learning environment in which modeling instruction is the way that that students are learning their science, is a lifelong pursuit.

Ray Howanski (14:56):

So you go to a workshop and, we see that continual professional development is really important. You don't go back that first year and all of a sudden, magically everything is solved. You're certainly better, right? And certainly a marked improvement. But over the course of several years, with continued practice, staying part of the community, being part of AMTA, staying in contact with those people that have been doing this for a long time helps those teachers to continue to improve and that improvement goes on. And there seem to be times of benchmarks. Like at five years and 10 years, there seemed to be significant improvements. So you can stay involved with modeling instruction, still be growing and learning and be showing significant gains, if you stay with it up to 10 years.

Ray Howanski (16:08):

So the thing that we've really learned, I think about modeling instruction, and it's really been part of modeling instruction from the beginning, is that, it's not a one and done. It's not your typical professional development in a school district where you go in and you have a day that you learn about something and you get a few tips and tricks

and you kind of are doing the same old thing with maybe you're changing one tool in your toolbox. This is really changing the whole approach. It's really a paradigm shift in instruction, and that's why it takes that initial 60 hours. That's why it takes the continual work at modeling instruction to become that expert and to maintain that level of results in the classroom.

Mark Royce (17:07):

Yeah. Interesting. AMTA has been primarily involved with providing opportunity for teachers to attend the modeling workshops. And so what have you and your team learned about distance learning? I know there's workshops that are done online, and there are workshops that are done face-to-face. What are you guys learning about how to best, as a teacher, grab on to modeling concepts and to develop as a modeling instructor?

Ray Howanski (17:43):

So, first thing I will say is, I just wanna be clear that a modeling workshop is a trademarked phrase. And that modeling workshop does refer to a face-to-face experience. We have resisted, and will not call those distance learning experiences workshops. Those are distance learning courses. A workshop is a special event. A workshop is that transformative experience where you have enough time immersed with colleagues where you get to have the professional learning, but you also get to practice with each other face-to-face. And you can imagine it's more than just learning how to follow a certain technique. It's an art, right? You're reading body language. There's a flow to the classroom, and you get that feel in a modeling workshop.

Ray Howanski (19:09):

You see how an instructor, when they assign problems or a learning task to the students, and the students are whiteboarding, that teacher flows around the room and they listen to each of the groups as they're talking, and they take in where everybody is and they give feedback. So that's the workshop piece. And that face-to-face piece is really critical. And that's where the really good learning is. That's the goad, if you will, of experience of professional development for teachers and modeling instruction. However, we know that's a lot, right? For teachers to go and have a three-week, two-week experience somewhere, you know, it's a lot. And especially since Covid, right? It's a challenge that more and more people want to have these experiences online.

Ray Howanski (20:16):

So one of the things that we've been experimenting a little bit with is a hybrid, of possibilities. So, can we in a one-week get enough of those face-to-face critical experiences of managing whiteboard creation and sharing and managing discourse, some of the even, conducting some of the experiments, how does that go? So you can condense that into a week and then have the rest of it be hybrid or the informational piece. So that's something we've been hoping that gives more people access to modeling instruction. But we don't sacrifice that critical piece of that face-to-face interaction.

Mark Royce (21:13):

Has that style of workshop been implemented? Have you guys actually done some of those, or, or is that something that's coming?

Ray Howanski (21:22):

No, we have actually done some of those, had some this past summer and we're tracking to see what that looks like for these teachers as they go on and implement modeling instruction, in their classroom and how that works for them. So that's something that we're really interested in. But distance learning is a difficult piece. Now, once you've had a workshop, as a follow up, as a second modeling instruction experience, a distance learning course makes sense. 'Cause now you, you get it, right? You've been there, you see how the classroom is run. Hopefully you've had a little experience and then, you come back and you take a part two of a course or an advanced section of physics or an astronomy, something like that.

Ray Howanski (22:20):

And that makes sense, right? It works for people. But we really are very resistant to having those workshops replaced with distance learning courses. You are using them for like introduction, right? That's fine. We get people an introduction to modeling instruction as a distance learning experience. We'll use them as a follow-up to a workshop if you wanna stay in touch and get some support as you're implementing modeling instruction in the classroom. So we're trying to look and see how that distance learning can support the implementation of modeling instruction.

Mark Royce (23:03):

Give us a little insight as to where you see the AMTA headed, like what's cooking in the background. What are the plans for the near future? What are you guys talking about these days?

Ray Howanski (23:18):

So, what we're working on right now actually is, and believe it or not, right now we're talking September and Sue Rea, who is our director of member services, so I have to give a shout out to, just does a fantastic job in contacting hosts and leaders of workshops and coordinating it and getting it all to happen. Now, in addition to that, what we're really working on, Mark, is we found that COVID really kind of disrupted our flow. Lots of folks were not able to have workshops over that period. And then didn't start up again. So we've lost some sites and lost some hosts for modeling workshops. So what we're working on now, really Mark, is we would really like as many modelers as possible to present at their local and state science gatherings. So, we're contacting folks, from the past and also new folks that we're reaching out to, to just expand the exposure because for our money, anybody that finds out about it and really learns what modeling instruction is...

Ray Howanski (25:00):

They catch it and it never leaves 'em. So it really is about giving people a chance to get exposed to it, learn what it is, and really critically have an experience with it. Because as a teacher, you change how you teach when you've learned differently, right. You have to have a different experience with learning. So once you get that, then you say, oh, yeah. Like, that's why the learning environment has to be changed. That's why it has to be really centered around sensemaking and having the students gather information in the lab, and then work together with each other to kind of make sense of it, present it, and that's the -ing in modeling, right?

Ray Howanski (26:02):

We really want those students be to be doing that modeling. And when you have teachers do that, they have to do that. So in these workshops, in these meetings, the more folks that we can have that experience, that actually see how that changes their learning. And this is very much a part of it, it happens for the teachers and the students. The way that the modeling instruction was designed from the beginning and the way it still happens now. One of the really critical pieces is it's based around how the brain actually works. Modeling was really early on in brain science. Hestenes, one of his areas was psychology, right? He was a psychologist. So he understood it was really like really important to resonate with how the brain was actually working. And it's not about chasing some kind of educational mandate. It's not the latest edict that's been handed down, this is the list of things you have to know, and this is what you have to do. It really is based on how humans actually learn about the world they live in, and how science has been developed over the years. That's a really important piece. And when you give teachers that experience and they see how different that experience is, then they get on board and they're willing to commit the time that's needed and stay with it.

Mark Royce (27:48):

Yeah. That's good.

Ray Howanski (27:49):

So Mark, we have some other things going on as well. At AMTA, lots of folks have collaborated to update and revise the middle school resources for modeling instruction, that's available for middle school teachers that are implementing modeling instruction and really good resources. And the other really exciting thing is middle school math. We've developed some units in middle school math and that has gone really well and been well received by teachers and workshops. So we've run a couple summers of workshops, there in Arizona with middle school modeling math. And also have some pretty cool projects going with the LIDAR grant, is an NSF funded grant. We're doing work with the RA software, a team of educational researchers, and looking at what data visualization tools are being used in terms of augmented reality, develop sensor-based, magnetic field visualization, which is really cool. And, also, looking at ways to visualize motions. The teachers sometimes struggle with using some of these tools. And so, there are some researchers going in and working with classrooms and seeing what those struggles are with teachers and helping infuse some of this technology. This is being used on cell phones, so making good use of cell phones. So that's some pretty cool stuff. You're right on the cutting edge of what can be done with some of these technologies that are available to the students.

Mark Royce (30:14):

That's very cool. Very cool.

Ray Howanski (30:16):

Yeah. And the other thing that we're trying to get started is, we're trying to get something started with data science. There's some things getting started in terms of creating standards with data science. And again, Colleen is out there, meeting with the folks that are developing these frameworks and really encouraging modelers to be part of the conversation. The more folks that we can get to be part of the conversation, the more we can have modeling influence how these new initiatives go. They have a survey out now, and I know we're looking for people to be involved in that survey and that's been out on the list serve. So hopefully people will respond and we'll get it out in the newsletter and folks can respond and let folks know what we're thinking as modelers about how we should be doing data science.

Mark Royce (31:27):

So. Okay. You said it's on the listerv and you're gonna put it in a newsletter, but how do people connect with you guys to get involved with these projects? Do they, can you do it through your website?

Ray Howanski (31:41):

They can just email me directly at amta_exec@modelinginstruction.org and we will get them involved. And lots of different things to do as part of the project. But you know, the first thing is, just be willing to respond to surveys and give us input and just be part of the conversation.

Mark Royce (32:07):

One of the projects you mentioned, you said that some of these experts were actually meeting teachers on site, at their schools. Is that correct?

Ray Howanski (32:18):

Yes, that is correct. Yeah.

Mark Royce (32:20):

If somebody wanted that to happen at their school, what would they need to do?

Ray Howanski (32:24):

So again, they could reach out to me and I can connect them with Colleen. I think that'd be the easiest way to do it.

Mark Royce (32:30):

Cool.

Ray Howanski (32:31):

So, yeah, she's been out there working with classrooms and seeing how those cell phones can be used effectively in the classroom to gather data that that can be used to develop and refine models and

Mark Royce (32:51):

Very cool.

Ray Howanski (32:52):

It's really, really impactful stuff and, you know, state of the art.

Mark Royce (32:58):

Share your email one more time slowly.

Ray Howanski (33:01):

Sure. My email is AMTA exec at modeling instruction dot org.

Mark Royce (33:13):

So we have quite a few people listening to this recording. What would you like to say to the community of modelers that are listening right now to what you're sharing and, and is there a message or something that you'd specifically like to communicate to modelers?

Ray Howanski (33:33):

Actually a couple things that I would really like to communicate. One is that in all likelihood, there's some really good stuff going on in your classroom and stuff that would really help others improve their instruction. So please be willing to share your gifts. And share what you've been able to learn about and do. It's how other teachers will learn. The modeling AMTA is only as strong as the modelers that make it up. It is a community of folks that work together to improve instruction, teachers supporting teachers, right? That's where it's at. There's nobody that's gonna come from on high and it's gonna solve all our problems, right? It really is built on what actually happens in the classroom.

Ray Howanski (34:50):

And again, typical pd, a lot of teachers will think we've all, you know, as a teacher, you know, we've all had this, you say, ah, you know, that's great in theory, but how, you know, that's not actually gonna work in the classroom, right? And it's usually because somebody's cooked some idea up, right? And not in the classroom. But modeling instruction has always been really rooted in the classroom and the real experience in the classroom, right? So, more they're willing to share the good stuff that's going on on in their classroom, the stronger organization and the more support modelers can be to each other and to the science community as a whole. And the other is like, I was just saying we really do need folks to be willing to spread the word, to be ambassadors for modeling instruction. We need folks to be willing to go to their local gatherings of science teachers, within their school, within groups of schools, state conferences. We just need folks to spread the word and for people to learn about what's happening in modeling instruction and why it's such a great tool. I mean, it's always been upfront and we wanna keep it that way.

Mark Royce (36:21):

Does the AMTA have a place online or some vehicle through which modelers can share what they're learning with other modelers?

Ray Howanski (36:33):

We do. We have a Discord, which is threaded discussions where folks can interact. And we also have listservs that are posted, and other teachers respond to questions and support each other. So the Discord is the latest way to do that. But either of those work. And there are some Facebook groups. And, um,

Mark Royce (37:01):

If you'll send me links to any Facebook or other social media or locations, we'll post them on the website. When people click on this episode, 61. If they click on episode 61 on the website at sciencemodelingtalks.com, we'll include any links that you send me.

Ray Howanski (37:22):

Cool. Yeah. That's great. So Erica Posthuma is the one that manages the social media. She does a great job. So we definitely get some interesting conversations going on that social media.

Mark Royce (37:38):

Cool. That's awesome.

Ray Howanski (37:40):

The other thing that I would like to mention to modelers is that there are opportunities for working on curriculum, basically the resources that support modeling instruction that we could really use some help with. And, we know during the year is a tough time, but if we could gather the folks and have some meetings during the school year, always updating and revising. In the last couple years, chemistry has been revised with some really thoughtful revisions centered around proportional reasoning. And that has really upgraded that recently. And then, we have computational modeling physics first, which is a really powerful course that is now included the computational piece that is so important for students to be learning. Updating the biology. This is work that's ongoing. And so, again, we know that the teachers are doing great work in their classrooms. And we know as good as the modeling resources are, that they can get better. And be updated and things change. And we really would encourage people to become part of that process of continued improvement.

Mark Royce (39:25):

Yes. And I assume that people can get connected through the AMTA website. Which is modelinginstruction.org. If you're not already aware of that. Modelinginstruction.org is a great place to find out more about what Ray's talking about, and also to get involved as a modeler in the things that Ray has shared.

Ray Howanski (39:55):

I do want to make sure that I take just a minute to thank all the people that have put so much into modeling instruction, developing modeling workshops, developing the modeling resources. I hesitate to say names because there are many, many people involved.

Mark Royce (40:18):

Yeah. You know, there's so many. We started this podcast a few years ago, three or four years ago, and I've spoken with over 60 people and the amount of passion that modelers have for modeling is just really incredible. It's been surprising to me. I've really learned a lot just talking with y'all. 'Cause I got involved 'cause my wife is actually a

modeler and I saw her passion and I thought, wow, this would be an interesting conversation to have with people. And boy, you're right. The people who have contributed, many, many people have contributed to this effort. And it's been great. It's really been great.

Ray Howanski (41:00):

It really is, Mark. You're right. People go into teaching really to help students, right? They really want to help the students. And when you actually try to do it, it's so hard. It's so hard to do. And if somebody hasn't actually gone in the classroom and really tried to make an impact it's hard to appreciate how difficult it is. And again, when you find something like this is well thought out and it's so helpful and you see the difference and you see how it impacts the student thinking and what gets done, that's why the passion, right? Yeah. That's why the passion.

Mark Royce (41:51):

Well, Ray, it's been awesome talking with you. I liked getting to know a little about you and the insights that you have as the XO of the AMTA. So keep up the great work and we look forward to hearing from you too in the future.

Ray Howanski (42:10):

Hopefully I'm gonna get out there and hang out with you someday, Mark.

Mark Royce (42:13):

Well, that'd be great. We're on opposite ends of the country, but

Ray Howanski (42:17):

<laugh>, but when I get out there from time to time.

Mark Royce (42:19):

Okay, cool.

Ray Howanski (42:20):

Yeah. Cool. That'd be great.

Mark Royce (42:21):

It's been a long time since I've been on the East Coast, but, uh... So hey, thank you very much.

Ray Howanski (42:28):

Thanks, Mark. Have a great day.

Mark Royce (42:29):

You too.

Ray Howanski (42:29):

Much appreciate it. Alright, bye. Bye.