

Mark Royce ([00:00](#)):

Hi, Kathy.

Kathy Harper ([00:01](#)):

Hi, Mark.

Mark Royce ([00:02](#)):

How are you?

Kathy Harper ([00:03](#)):

I'm doing great. How are you?

Mark Royce ([00:05](#)):

I'm doing well too. Thanks. I'm excited to get going on our conversation and talk to you about your roles and how you're implementing or supporting the modeling efforts. For our listeners, tell us a little bit about yourself and what you're doing at the university.

Kathy Harper ([00:26](#)):

So I'm working in the department of engineering education at Ohio State. I teach in our first year engineering program, primarily teaching honor students. So that's a really great time. It's been a transition. It's a different world from teaching introductory physics. I started my career teaching introductory physics to the same population, and that was really where all my experience was when I started with modeling. And for 14 years, I was a director or co-director of workshops for primarily Ohio science teachers in modeling instruction. We started with one physics workshop, and then at our high point, we were running four simultaneous workshops. During the summer, we would just kind of invade the science wing of a local high school and bring all the biology and chemistry and physics teachers together, and just really have a sort of like a camp experience for three weeks.

Mark Royce ([01:24](#)):

Hmm, awesome. So tell me about how you got connected with the whole modeling world.

Kathy Harper ([01:33](#)):

So it was kind of a mistake. I wanted to become connected with the modeling world as soon as I saw some initial talks that were given by David Hestenes and Rick Swackhammer, and Larry Dukerich at the AAPT meeting in Notre Dame in the mid nineties. And I had written to Jane Jackson to indicate my interest, and I was just a physics graduate student at that point. And it didn't really seem like there was a spot to involve a graduate student at that point. But, by some luck, the Cleveland school district connected up with the modeling folks and wanted to send a teacher and somebody from the local university, I was at Case Western Reserve University at that time, to the workshop in Chicago. And the first person that they asked was a faculty member that I had worked with a lot and he was not available that summer. So I got to go after all and it completely changed my life. I mean, both professionally and personally.

Mark Royce ([02:34](#)):

Wow. So how did it change your life? Explain that.

Kathy Harper ([02:39](#)):

So it was interesting because I was starting to do a little bit of research in physics education. And so I was familiar with what the research said in some areas about misconceptions, but I hadn't really put together that this great framework was really a much more effective way of teaching physics than what I had been doing. I remember when I had this great epiphany. So I had already taught two summer classes at that point. And I thought I was pretty good. You know, I was an award-winning TA and I seemed like I had my students really engaged, and they seemed like they were learning a fair amount, but almost every day I would come into class there in the summer and I would have some kind of demonstration, right. And I would ask the students to make a prediction about what would happen and they would get it wrong. And then I would gleefully show them what really happens and I'd feel like I really had them hooked at that point. Right. Because that's what a lot of the research at that point told us we should do. Right. We should bring the students into cognitive conflict and that would really get them interested. And, I didn't completely have the epiphany. You know, epiphanies take awhile to get to, but when I had my epiphany, I remembered a particular mechanics class that I had taught where I had the demonstration set up. This was towards the end of the term. And I asked the students, what do you think is going to happen? And one of the students that was doing extremely well in the class said, well, I can tell you what I think, but since you always set us up, I know that's going to be wrong. And of course... Of course they were wrong and we did it and I didn't really think about it. But then one day in the workshop, it occurred to me that, Oh my gosh, I really had been setting up my students to be wrong almost every single day. And why were they coming back? You know? I mean, that had to be horrible. Why would you go to a class where every day your teacher would publicly ask you to be wrong and then tell you it was okay. I mean, it couldn't of felt okay. So instead, what modeling does is we set up our students to be right. Almost every time in modeling, when we ask our students to make a prediction, we've already given them the evidence or the reasoning, to be right. And then when we do need to see whether those misconceptions are in there, they've already established a nice groundwork, right? They have a great way to talk about it. Some of the misconceptions then in a cognitive conflict model, we would be trying so hard to get the students to articulate that they don't get articulated. And in that sense, they don't sit with the students as powerfully. Because they never gave it the power of putting it into words. And so it's actually easier, I think for them to, to put some of those ideas that are not scientifically accepted to the side and construct really from their own observations, things that are in accordance with the way science works. So I love setting students up to be right. So, I mean, that was just transformative for me as an educator. The other thing it did is right. It gave me a community of other teachers. I already was pretty well connected with local, Northern Ohio AAPT, but this was a group of teachers that cared enough about what they were doing, that they gave up five weeks of their summer. I say, give up, but invest is maybe a better word. We invest five weeks of two summers to come together and learn more about how to teach physics. And then of course we couldn't stop talking about teaching physics and our families and all that kind of thing. And, you know, I was, I think 23 at the time. So basically I had, two dozen new parents here at the workshop looking out for me, some of us got invited to each other's weddings later on, you know, we still exchange Christmas cards. And, and that was just the beginning, right? Because then we started connecting with other modeling people. And then when we brought modeling to Ohio, we established our local community. We're looking forward actually to having a virtual conference this Saturday, and just people starting to joke around with each other through email before we get together virtually, it's just a great, it's a great professional family to be part of.

Mark Royce ([07:06](#)):

Yeah. Tell us a little bit about how at the university you are influencing the modeling approach. Modeling focuses with our high school, middle school teachers, primarily, what are you guys doing at the university in the modeling world?

Kathy Harper ([07:26](#)):

For me, it's been different since I've moved into teaching engineering. I teach engineering a little bit differently than some of my colleagues. So we work from a common set of course materials. It's really fabulous to be part of a team where we can all agree on the basic content that we're going to present every day and the activities that our students are going to engage in. But one of the things that I find that I do is I flip the order of things a lot. So I definitely do not present things as facts and procedures any time that I think the students can make observations and bring those observations together in some organized way to proceed. I think I am probably more hands-off than most of my colleagues. And I think that goes back to my modeling training. So even when we're having our students build things in class, I think some of my colleagues are a little quicker to say, well, you know, you really ought to do it this way. And I'm much more of the mind of saying, well, watch that happen again. And do you see what I see? Take a look, do that test again. Why do you think the robot is going to the left instead of going straight? So I think there's a difference there. And I think it's really empowered my students to be better designers and better testers of their designs. So I've been doing that for about the last 10 years and most of my physics experience now comes through running the workshops, but I can back up because I've been modeling now for over half of my life. And I spent many years teaching physics, often within constraints where I was teaching in parallel with other people who were not modelers. And, they weren't all going to adopt all of those practices, but it definitely influenced the way that we approached our classes. And I started out at Ohio State as the student of Alan van Heuvelen, who of course was one of the visitors to Arizona State back in the early days of modeling with David and they had many conversations, I'm sure. And you can see elements that Alan developed that are infused throughout the modeling curriculum. And so here I was working with the guy who invented these elements, and I was learning how to model at the same time. And it was great. So we were able to do sort of a... it wasn't full-blown modeling. I would say we taught in any, any modeling-esque kind of way, because we were never able to have the students in small enough groups that they could do all the experiments. We couldn't send them to the lab whenever we wanted to. They couldn't all be in lab the same day of the week, even given the constraints of the department. But what we could do is we could take some of those essential paradigm lab experiences, such as figuring out what constant velocity really means. With bean bags or whatever you want to do. And we could do that as a group experiment, demonstration kind of thing. So you could have students come up and do some of the activities in front of other students, or you could have the class tell you what to do, but again, really focusing on the observations, right? Not delivering facts, but focusing on the observations, really observing well, thinking about what you can manipulate whenever you're setting up an experiment to collect data and then really showing the students how to manipulate and linearize that data. So often to connect it up with their mathematical understanding and to get them to see that these fundamental scientific relationships just come from a mathematical treatment of data that they've taken. That these are not, these are not principles that were handed down on tablets. These are things that people figured out by setting up good experiments, making good observations and analyzing the data. And so one of the things that I always loved, and I was teaching honors students. So a lot of them had had some physics in high school. What I always loved was the moment where we got, we got to the first kinematic equation. So we would have a vehicle move across the front of the room at a constant velocity, although we weren't calling it that yet. Students would drop beanbags every so often we would take, you know, measure the distance between the bean bags. We would plot that, get a nice straight line and then apply  $Y = MX + B$

to it, to get this equation out. And as that moment was approaching, that the graph was on the chalkboard and substitutions were starting to be made, you know, putting in a T instead of an X and all that kind of thing to turn the math way that they were used to seeing this equation into a physics way of seeing the equation. I would hear gasps come out of the lecture hall at different times as different students realized what was going to come next as they were starting to jump to the punchline. And so then I would turn around and say, how many of you have seen this equation before? And almost everybody would raise their hand. And then I would say, how many of you ever arrived at this equation in this way before? And, you know, a few people would raise their hands. And I actually, as we had more modeling teachers in Ohio, more people started to raise their hands. So that was great for me. So was I ever able to do a full-blown modeling thing in my classroom, the way that they're able to do at Arizona State or at Florida International? No, but it totally changed the way that I approached my classes and it empowered my students to reason-- I think-- much, much more carefully than they had in the past. And to think about the process of science much more.

Mark Royce ([13:23](#)):

Yeah. I know you're involved, very deeply with, helping, educators to develop curriculum in the modeling framework. Can you talk to me about the work that you're doing there and how that's unfolding?

Kathy Harper ([13:40](#)):

So part of being in the national workshops back in the early days, it was a three summer commitment. The first summer we took a workshop using the mechanics framework, the mechanics curriculum as a framework. And then we got together the second summer, and I'm not sure that we were completely sure what to expect. And I think we were all a little bit scared when we were told, well, what you're going to do is you're going to pick a topic and develop some modeling curriculum to go with this topic. So other predominant introductory physics topics, but we don't have curriculum for that yet. And we ought to, so, some people worked on optics, waves, electricity, and magnetism, things like that. And a few weeks into it, I realized that in the first summer and using stuff from that first summer in my teaching that year, I thought I understood what modeling was, but it wasn't until I started trying to make something with it that it really all clicked. Right. And I think that's, that's sort of the analogy of, you know, giving somebody a fish or teaching them how to fish. So I was now at the point where if I had to teach a class and you couldn't hand me a modeling curriculum, I still had enough understanding now of what really made it work that I could do a decent job of putting together experiences for my students, that would again, be focused on observation and processing the data and putting together that model and articulating the model with all of its multiple representations. So I had that experience in my second year of the workshop. And then in the third year of the workshop, we did more of that work. And, whenever I led my first workshops, those were also two year workshops. And again, the second year was working on taking those curricular materials that my comrades and I had put together and refining them, making them better. And then when we started doing our workshops in Ohio, I felt pretty strongly that the teachers that we were introducing modeling to also needed to have that experience. So the first year we did a mechanics curriculum and the second year we invited everybody back to write curriculum. And, it was interesting to see what was going to happen. And what we found was that those teachers said the same thing I had said, wow, I really thought I knew what I was doing this year. And now that I've tried to build something with this framework, I realize that there were just so many more layers to this that I didn't understand. So from then on, we have always offered a curriculum workshop as an option for anybody that has taken a first year modeling workshop in physics or in chemistry. We were moving towards trying to get the expertise in the room to offer a biology one whenever our funding dried up.

But getting teachers to come back and just really dive into like two or three weeks worth of curriculum and really take a harder look at what makes modeling modeling, is so empowering. And so we have now, you know, 14 years worth of teachers saying, Oh my gosh, if you can possibly take a curriculum workshop, take it because it will deepen your understanding. And it gives you the power that if you're put in a situation and it happens to teachers all the time, right? Particularly science teachers, if you're put in a situation where your principal says, well, you know, science is all kind of the same. And I know you've been teaching chemistry for the past 20 years, but you're going to teach physics this year and you'll be fine. Or your state changes their standards because that happens too. Right? If any of those things happen, at least now there's some tools, you know, to fall back on. To try to take your, your modeling being with you into this new adventure.

Mark Royce ([17:45](#)):

So share with us your perspective on how modeling and the new national standards are connected and, what's your little crystal ball work here on how you see that all working out.

Kathy Harper ([18:03](#)):

So I don't know if I have a crystal ball, but I do know, that modeling was one of the approaches that the folks putting together, the framework that turned into the NGSS looked at. So it's absolutely true that modeling had some influence on the NGSS. And I love the fact that NGSS really does focus on the observational nature of science and that it seeks to integrate the sciences in a way that is so important. It's easy to think that chemistry is totally separate from physics is totally separate from biology. And of course, none of that is true. They're all interrelated. And I think those threads that run through the NGSS explicitly have really helped us there. So I was really glad to see that coming along and hopefully it will continue to come along in other parts of the country. I'm more familiar with what happened in Ohio and we're really, really fortunate in Ohio that at the time that they were last redoing our state standards, a couple of the teachers that were invited to be on the committee were people that had taken modeling workshops. And so in Ohio, you can actually see modeling-type things show up in the standards to the point where there is actually a footnote that recommends modeling workshops to teachers. So as long as that footnote is in there, I'd like to think that Ohio teachers will be looking for modeling workshops

Mark Royce ([19:43](#)):

At the university level... You're very active with modeling workshops at the university level. What is your connection with the modeling community on a larger scale in your area? Maybe your relationship with the AMTA?

Kathy Harper ([20:01](#)):

So the modeling community in Ohio came about, I think from a couple of different things. So, one of the first national workshops sort of in the second phase was actually in Akron. And so a number of experienced teachers went and took that workshop. There were four teachers from Ohio that were in that very first group that went to either Chicago or Arizona State to take those first national workshops. So there was a very nice seed here. The way that our workshops actually got started was that a teacher actually in my school district that I did not know at the time. And I, I had, I think one kid who was what under two at that point, called me up one day, he had called Jane Jackson asking about modeling things and she said, call Kathy Harper. And he did. And he said, I kind of want to go to North Carolina and take this workshop, but I'm trying to figure out whether it's worth it. And I still remember what I said was "Go, it will change your life." I didn't realize that modeling was going to change my life a second time.

Right. We already talked about how it changed my life when I went to my workshop. So, this teacher was Jason Serveneck, and it seemed like he had barely unpacked from being at the workshop, but maybe it's really true that he taught a few classes first and he called me up and he said, "Oh my gosh, you're right. This is fabulous. How do we start offering workshops here so that I have people I can talk with about this?" He wanted to spread this great way of teaching and he wanted to develop a community. And so we wrote our very first grant that year --grant proposal to get the workshop funded. And then we were off and running for 14 years and growing. And so what has been really cool, it was about a teacher, a real teacher in a K-12 situation that said, this is important and I need to share it. And so I was able to help get him connected. We had a colleague at the university that walked us both through the grant writing process and helped us lead those early workshops as well. But then seeing again, motivated teachers come together to find other motivated teachers, you know, physics teachers in particular are so isolated. Chemistry teachers are maybe only slightly less isolated. So to find this community of which soon became science teachers that could talk to each other, that again, they connected both professionally and personally. They're lifelong friendships that have been forged through all of this. I was just the person that knew the right people to connect up in the beginning and I had experience running workshops. And then once these new leaders emerged out of our workshops to continue to lead more workshops, then I was able to just kind of make sure that everything was running, make sure that we had money, make sure that people were fed. I would still be allowed to come in and make guest appearances to talk about, you know, science education research. So I think, my role has been the catalyst, I think, and then we had people from all over Ohio come and sometimes from other states. We still primarily would draw from central Ohio, but then there were spinoff workshops. So a couple of people from the Toledo area got together with people at Bowling Green State University. And they've been offering workshops for a bunch of years. Somebody in Cincinnati called us up and said, we think we should be hosting these. What do we need to do? And so we helped them get through the grant proposal process. A couple of folks that went to our workshop met up with some people from another workshop that all lived in Cleveland, then they started offering workshops. So, sometimes you just need to plant the seed. And again, when it's a great educational innovation, the universities can help by being those maybe cohesion points or, you know, the little nuclei for, for the cohesion, I guess. But the teacher to teacher thing has been the most important thing about modeling. I think that is the thing that sets it apart. You know, a typical educational innovation lasts five years or less. Modeling is closing in on three decades. And it's because the teachers care about it. They know it works and they share it with each other.

Mark Royce ([24:25](#)):

Yeah. It's even how AMTA was established was through that kind of grassroots network of individuals. Modeling workshops started out focused on physics at the beginning. And then chemistry workshops have been developed. Biology is in development and doing quite well, but you mentioned engineering workshops and I had not heard of that until you mentioned it. Can you talk to us a little bit about engineering and modeling?

Kathy Harper ([25:05](#)):

As we've mentioned before, I kind of have one foot in the physics world and one foot in the engineering world. I have degrees in both. And so as I started teaching engineering more and starting to see connections there and would talk with my friends, my modeling friends in Ohio, they would ask questions about what could they do to help their students understand what engineering was. How could they help their students be not necessarily better prepared, but more informed? One of the things that we find is that a lot of students that show up for a first year engineering program are kind of doing it on

faith. You know, somebody told them, "I don't really know what engineering is, but I think you'll like it." And you know, that's, that's maybe not the best way to choose your major. I have to admit when I started my undergraduate engineering degree, I didn't really know what it was either. So we talked about it and, we had this idea and it was what if we offer a one-week workshop for people that have already taken a modeling workshop to come in and we'll just work through ways that we can add engineering into an existing modeling curriculum. So, as it turned out, everybody that showed up that first year, I think almost everybody, I think everybody had taken a curriculum workshop with us already. So they were already very comfortable with developing things. So that was a good way. And we really approached it as a group of colleagues. So I started off the workshop asking people, why are you here and what do you want to learn? And then we'll see if it matches up with what I think I can help you learn. And the good news is it matched up really well. But one of the things I really remember was one teacher said "My advanced students are usually debating between a career in medicine or a career in engineering. And they all feel like they understand what medicine is. And so I think they're more likely to choose that, but they don't really understand what engineering is." And another teacher without missing a beat said, "heck I don't understand what engineering is." So we worked then as a group to think about some activities that we could add, just to introduce students to engineering design that were largely independent of content. So things that you could put in just for a day or two here or there. And then we really looked at how could we incorporate elements of engineering design into the deployment phase of a modeling cycle. And so then, we spent probably about half of the workshop time developing, piloting, different activities for a variety of physics and chemistry concepts that we could put an engineering spin on. So even taking something, maybe like one of those activities that you might do in class because it's fun, you know, the egg drop or whatever. And how could we make it a little bit more like engineering? Could we add some discussion of iteration? Could we have the students talk a little bit about the scientific principles that they were applying to their design? Could we add a cost factor into it? So I got invited to visit a friend's classroom later that next year after she had been in the workshop and she had put together this three or four day egg drop activity where she had a store. She opened up this little store, you know, in the side of her classroom. And I don't know if students had monopoly money or she just, I think she just ran a tab for each one, but basically she had all these materials for them to choose from. And so they had, you know, a certain budget and they had to pick the materials and they had to write about how impulse and momentum were going to be important and what they were doing. And they had to plan their design and then they made their design, you know, and then they tested them and they wrote about what they would do again later. And it's not gobs of engineering, but it's a flavor of engineering, and I think one of the best things that we can do is to hit home that, you know, any good engineer is going to know the science. They have to know the science first and be able to apply it in a good analytical way. It's not just messing around with something and hoping that the egg doesn't crack when you drop it. Right. You can't do that with, with real products. You can do a little bit of testing, but you know, there's some things like bridges, you, you kind of have to get it right the first time.

Mark Royce ([29:45](#)):

Awesome. So you're actually hosting engineering modeling workshops. Is that correct?

Kathy Harper ([29:52](#)):

We've done two of them. So we did two of those workshops. And then, our funding disappeared and it's been a little bit hard the last couple of years to get things back up and running. We really do hope to be back up and running, with a new model. But you know, COVID has changed everything.

Mark Royce ([30:12](#)):

Yeah. Have you been teaching online courses or workshops? The virtual?

Kathy Harper ([30:20](#)):

We have not done any online modeling workshops. I've been teaching my own classes at the university virtually, which has been interesting. Teaching engineering design virtually is, is really interesting. It's much harder to help students, figure out what's going on. Sometimes when their designs aren't working the way that they expect them to you just, you just can't see things as well. So we have not, we have never done any virtual workshops, in Ohio through the group that I've been working with. I shouldn't speak for the whole state, but the gang that I've been working with, we've always done everything in person. This model Palooza we call it will be our mini conference this Saturday. That will be the first time we've done something virtually. So we'll see how it goes.

Mark Royce ([31:05](#)):

Tell us about that event.

Kathy Harper ([31:08](#)):

Model Palooza came about, oh, about four or five years into us having sustained workshops here. So when we had these curriculum workshops, you know, that the teachers would work on the curriculum over the summer and then try them out in their classrooms. And, we always had follow-up sessions during the school year. About three Saturdays sometime during the school year, people would come back together and, for a content based workshop, you know, introductory chemistry, or introductory physics, you know, you always had some content that you could still work through. And it gave, of course the teachers a chance to reconnect and talk about things that had gone well. And, Oh my gosh, whiteboarding takes so long. And to find out that everybody else was having the same experience was always, I think, very good community-building experience. But a chance to go through some more activities, watch the leaders again with, with new awareness of what they were really doing, get a chance to practice your questioning a little bit more. But so we would do that. But then for the people that were doing the curriculum, it wasn't as clear what fit into a follow-up for them after a couple of meetings. And so at some point we said, well, clearly what we should do is in the last followup of the year, we should set aside some time for the people that have developed these new curricular units to introduce them to people in the first year, so that they could see some new topics that they didn't have materials for yet in the modeling framework to kind of again, start expanding their view of what modeling is, and think about what you do without having that big binder of material in front of you. So that's what we started doing. And so then we said, well, Hey, you know, shouldn't, we be inviting back people that have taken previous workshops with us because, you know, there might be a topic that somebody has developed some new materials for that would be really helpful, right?

Kathy Harper ([33:06](#)):

So we start inviting all of our alumni to come back. And so pretty soon it was getting bigger and bigger. And we knew that we couldn't pack all the people that were coming into rooms, just, you know, with workshops, by people that had made new curriculum. So we started inviting people to suggest topics that they would like to lead discussions on or present on pedagogical techniques or again, you know, modeling content-based things. And so it just turned into a mini conference. So I think, at our peak we had about 120 teachers. We've had some people come from out of state to join us. We usually try to advertise it. We've had several of the AMTA executive officers come and present over the years, which



has been great. So it's just, it's sort of like your pedagogical family reunions, right? You get back together, you see people who you were in workshops with, or that you learned from, people that you've heard about. It's really been a great time. That's something that I think we all really missed last year. COVID hit just the week or two before we were going to meet last year and we canceled it. And this year we have things kind of subdued because we think everybody's kind of Zoomed out, but they want to get together and see how everybody's doing. So I think one of the things I'm most looking forward to whenever we get past COVID is Model Palooza 2022. Yeah. And I should credit my fabulous colleague in chemistry. Ted Clark is the one who named it Model Palooza.

Mark Royce ([34:46](#)):

And that's an annual thing. You don't do it more than once a year.

Kathy Harper ([34:51](#)):

We've talked about doing it twice. It seems like once is about right.

Mark Royce ([34:55](#)):

Kind of depends on how big it gets. So how do you guys market Model Palooza?

Kathy Harper ([35:04](#)):

Again, marketing has never been our strong point, for our group anyways. I think AMTA does a much better job than we do locally. So it just starts out with some emails to the listserv that we have here in Ohio and some emails to the broader modeling listservs, which I realized we have not done this year because you know, COVID, again, I think we're just all kind of at our rope's end trying to keep everything going. But basically we just tell all the people that have been with us in the past that this is the date. And, I feel like over half of our workshops now have all taken place at the same high school. And so that's usually where we go. People pay 10 bucks. We bring in lunch, we have a great time. Now, the last two or three years though, things have changed a little bit in that the local section of AAPT, the Southern Ohio AAPT, decided that they would like to have a joint meeting with us because they love the energy that Model Palooza brings to a meeting. So actually the last few meetings have been joint with them. And so we've, we've moved around a little bit again, but it's always someplace in the Columbus area.

Mark Royce ([36:19](#)):

It seems like you're probably getting a lot of innovative creative ideas that are coming through there and being shared with your community. And I would encourage you to think about pushing it more out, maybe through the AMTA to, you know, get more people aware of it and have access to those new resources. It seems like a great idea.

Kathy Harper ([36:41](#)):

We'll see how we do with going online this time, you know, and then once you you've proven you can go online, then I think it's easier to think about some new options in terms of connecting more people up with what's going on.

Mark Royce ([36:54](#)):

Kathy, you mentioned that, uh, you did two of the engineering workshops, but the funding ran out. How is the availability of funds impacting your world?

Kathy Harper ([37:06](#)):

So it's, it's the only reason that we haven't offered summer modeling workshops --well before COVID for a couple of years. And then it's a significant hurdle in getting back to that. So I know things have been different in other parts of the country, but in Ohio, we were very fortunate that the way the state handled the improving teacher quality funds, which were one good thing that came out of no child left behind. These were funds that were earmarked to the states specifically for math and science teacher professional development. And there is so much research that shows that quality teacher professional development must be delivered within the context of the content that they teach. And so what that means is if all of our funding for professional development ran through the school districts, which is what the trend is now, there's no way that a school district is going to be able to afford physics-specific, biology-specific, chemistry-specific, geoscience-specific, workshops for their teachers. There aren't enough, even in a large city district to justify those funds. So that means that math, which is also very important and reading, which is of course, incredibly important, get most of those dollars. The thing about modeling that was so important for developing the community, again, was this ability to get together with teachers from other districts who taught the same stuff that you did. And to be able to talk about that and to have content developed as a blend of pedagogy and content, which again, research shows is what should happen. And so, as long as there were resources out there that people could tap into to fund these workshops that would be offered to at least some geographic region where you could get enough teachers together to make it meaningful to have a workshop, then these things could go on. But when no child left behind was replaced with Every Student Succeeds, those dollars were basically funneled directly to the school districts. And there's some language in Every Student Succeeds that says the districts can pool their funds to offer workshops, but it seems like districts are reluctant to do that, or they are unaware of that. And so being able to continue these workshops, it's sort of just the right size, right? So like a big national thing, isn't going to reach your pockets of teachers and all the different States. And dollars just to the districts are not going to enable us to offer quality professional development that is tied to content. And so we need to do something to get those mechanisms back in place so that we can support these state-level, or at least, you know, portion of state-level workshops, where again, like-minded teachers can get together, talk about the content and the pedagogy. Where we can teach these workshops for the people who teach these workshops are real K-12 classroom teachers. Not university people like me; people that teach in very similar circumstances to the people attending the workshops. Those are key. So we need to find a way to get that back. I understand that it can sound very appealing to legislatures and parents when they say that the dollars are going directly to their school districts. But if they don't understand the way that professional development works in school districts, and they don't pay attention to the research that talks about how it ought to work, we're not going to be able to continue to give the teachers the support that they need to teach in these amazing ways.

Mark Royce ([41:07](#)):

So how do we make the changes that are necessary for the funds to be funneled more appropriately?

Kathy Harper ([41:14](#)):

That's a great question. And I have never been fabulous at advertising what I do or at advocating to the local powers. I think some teachers have tried and they've contacted their legislatures. I don't know how effective that has been. I don't know if parents have to ask. But it's a great question. I think the other issue is that sometimes people just want to give dollars to things that are new and we're not new anymore. So where are the continuation funds for quality professional development for teachers. We give continuation funds to scientists who find promising things to continue their work, but we don't tend

to give funds to educators to continue their work in influencing the new generations of educators. Again, I don't really have answers. I know what the answers are. I don't know how to get the money to make those answers turn into reality.

Mark Royce ([42:23](#)):

Well, maybe some of our listeners who are maybe getting inspired by what you're saying and motivated by what you're saying can start contributing to the conversation to help. That would be wonderful. So if you're out there listening and you have ideas on this, then, please step forward and see what you can make happen.

Kathy Harper ([42:48](#)):

Right. And, you know, AMTA, I think has done a great job of trying to get modeling more in the minds of districts and parents, but there's only so much that they can do. You know, AMTA is still a relatively small, fabulous grassroots effort, and just their focus really has to be on getting the word out to teachers and finding leaders for the workshops and making sure that those workshops are of high quality. But maybe there's a few people out there that could work with AMTA as the larger organization, to start approaching some legislatures. I think actually in Arizona, there has been some success there. So you could of course ask Jane Jackson about that. But if I recall correctly, there was some legislation passed in Arizona. That's going to help fund teacher professional development. But I don't know the details of that.

Mark Royce ([43:46](#)):

I know that AMTA is involved in trying to do exactly what we're talking about to make a funding more available, to working behind the scenes, to influence legislature, to create more funding for education and training. So, Kathy, we've talked about, a lot of cool stuff, and I really appreciate your insights. If you have, links or information that you'd like to share with our listeners, if you could email me a list of anything you think would be of interest and, I'll post it on our website at [sciencemodelingtalks.com](http://sciencemodelingtalks.com) and people can go there when they click on this episode, where with your conversation, there'll be able to find those resources there on the site. So if you could do that for me, it'd be great. I also want to just mention to those who are listening. If you haven't already, you definitely want to visit the AMTA website and explore it. It's [modelinginstruction.org](http://modelinginstruction.org), and you'll find lots of resources there if you, if you're not already aware of what they have there. So well, Kathy, it's been awesome talking with you, and it's amazing how fast the time flies. So I really appreciate you taking time out of your busy schedule to talk with us. It's been very enjoyable and very informative. Thank you.

Kathy Harper ([45:21](#)):

Thank you so much for inviting me, Mark. I'm actually really flattered that someone mentioned me to you. And it's always great to talk about modeling. So, if you're a listener out there that has not been able to connect with a workshop yet, go to the AMTA website or check at some of the meetings of some of your science teaching professional societies, sometimes you can find a teaser workshop there. There's a lot of modelers out there in the Twitterverse and all you have to do is look for them.

Mark Royce ([45:54](#)):

Yeah. Thanks Kathy for that. And I will see you again, I have a feeling.

Kathy Harper ([45:59](#)):

Thank you so much, Mark.