Mark Royce (00:00):

Hi Mike.

Mike Gallagher (00:01):

Hey Mark. Good to see you.

Mark Royce (00:04):

Yeah, you too man. So I'm excited to talk with you today about what's going on in Michigan and in your life and, and how it intersects with the modeling instruction community. So I thought we'd start out by just tell us a little bit about yourself, a little bit about your career. What led you to where you are today?

Mike Gallagher (00:25):

Sure thing. I currently work in Michigan is MiSTEM director; Michigan has 16 regions that are MiSTEM regions so I'm serving as the Oakland MiSTEM director for that network. And I work at Oakland schools, which is an intermediate school district. And in Michigan we have regional support agencies. Some States have ESDs, we have ISDs and I've worked there in several different capacities, mostly as a science consultant. And now I'm serving as their, MiSTEM region director and starting around 2014, we created a program called modeling in Michigan, which is a broad collaboration around the state. And at some point I can tell you more about the partnerships and the networks that really have made it work in this state. I came into that role there's, I think there's quite a history to my background that positioned me to, to help instigate and lead this effort.

Mike Gallagher (01:32):

And that is, I started my career as a geologist and as a research geologist based out of California and researching the continental margin of North America and also some risk assessment issues. I had opportunities to do some volunteer outreach programs with kids and got a little taste for teaching. And as opportunities kind of changed around, I decided to pursue education. And when I went back to school to get a certificate to teach, I had a methods teacher who used constructivist principles in the way he taught the secondary methods course that I had to take, every teacher has to take that to learn instructional strategies. So constructivist theories of learning manifest themselves with different programs. Modeling is one of them and modeling is probably the most effective in terms of transforming teaching and in science at the secondary level across this country, but there were other strands or cousin ships out there.

Mike Gallagher (02:42):

So my mentor instructor, the professor of that methods class, Jim Stewart was a colleague of some other constructivist, such as Arnold Arons at the university of Washington and Jim Minstrel at Mercer Island High School who worked him. And so my exposure to how to teach was an immersion experience in constructivist approaches. So I took that into the classroom. I think my research background they taught me that the things that I had the most fluency with was the things I researched. And by being engaged in research, I was steeped in the nature of science and how science works as a community, how knowledge is socially constructed, how empiricism works, our orientation towards skepticism and the premiere role of evidence, all those things. And I, you know, as a teacher, that's what I wanted to bring to my students.

Mike Gallagher (03:46):

So I was fortunate because in the early nineties, when I became a teacher, there were no state standards and no state tests, and there wasn't even resources for me. So I had to invent everything I did. And so what I invented were research projects and the, you know, it was kind of supposed to be a physical science class, but we studied watersheds. We studied earthquake risks. I was at the time teaching in Washington state, and those were very relevant issues as well as weather, hazardous weather and risk and those things natural hazards they require a solid knowledge in physics and chemistry and some biology. So I use the constructivist approaches that Jim Stewart taught me to help students have a good anchor in things like motion physics, or what Hestenes would call a constant velocity model.

Mike Gallagher (04:48):

And so we built the constant velocity model so we could understand stream discharge or plate tectonics motions and those kinds of things. So I had a, sort of a merging of a constructivist approaches with research basically. Some people would call it problem-based learning now, what I was doing. So you know, teaching in the classroom with a that approach was very rewarding, but then I shifted into these roles in regional support agency. I started that in Washington state and then coming to Michigan and working for Oakland schools. I had that opportunity to work with grant funds, for design and, and implement professional development and curriculum development projects. And we had a few different projects before we started modeling that was similarly along the same lines. We were able to compete and win a I think it was in 2006, we won a a math science partnership grant, which is federal funding that goes to each state to support science and math, and tries to leverage partnerships between K12 and higher ed.

Mike Gallagher (05:59):

And it tries to contribute to the research base and what's effective in professional learning. So we started a program called visions and I think by that time I had, I knew about modeling, but I knew more about what Jim Stewart was doing in summer programs. He, he used a research called constructing physics understanding that was developed at San Diego State by Fred Goldberg, who I think still today creates resources to be used at higher ed with teacher prep. Jim used it in summer workshops with teachers and the main objective was to deepen their content knowledge. The target group was fourth to eighth grade teachers, but they they actually drew in a lot of high school physics teachers who knew their content, but wanted to know more about the instructional approach, which was a constructivist approach.

Mike Gallagher (06:53):

So like modeling, it depended on investigations generation of evidence, like modeling. It depended on rich discourse like modeling the facilitator, the teacher would not be lecturing or presenting answers, but helping the learners construct their understanding. So when we won the grant and then tried to implement the visions program we you know, looked at maybe using that resource, but Fred Goldberg had created a new resource that actually can be transferred right into the classroom, which was interactions and physical science. And it was a textbook kind of targeting seventh and eighth grade. It did intersect with ninth grade physical science and/or physics. And one of the authors was a professor at Western Michigan university, Bob Pool. So we hired Bob Pool. And then he he encouraged us to hire Dale Freeman who was a high school teacher.

Mike Gallagher (08:00):

And they came in and did a workshop that was basically 200 hours long for two years that took our partnering teachers through a big chunk of that curriculum. So it was similar to the design of a modeling program where it was prolonged immersion, Michigan benefits from having a lot of very functional collaborative networks. I'm part of the, MiSTEM network. Now, ISDs collaborate quite a bit for 25 years. We had an organization called the math science center network. And our Oakland schools was a member of that network. And we had grant annual grant funds from the legislature. So what we tended to do in the Detroit areas some partners of mine in McComb and Wayne, we pooled our funds and we could do workshops. And in 2009-2010, we started to plan to run some modeling workshops in physics, using modeling resources, because like interactions and physical science, the great thing about that is it had materials that were amenable to being adopted by districts. as their curriculum, or at least a framework for their curriculum. So we started running those workshops kind of low-budget. We charged teachers back in those days, and we we focused on physics for three or four years.

Mark Royce (09:26):

So modeling has been a part of your Michigan focus for about 11 years, now. Talk to me about how the modeling approach has influenced what you guys are doing with your teachers.

Mike Gallagher (09:40):

Well, it's been profound and immense. We I mentioned that we started our program around 2009, 2010. That was because we discovered some amazing passion in a group called the Detroit Metropolitan Area Physics Teachers and their leader, Alan Gibson, pointed out some of my long-term partners, Laura Ritter and Don Patta. And and Don and Laura became our first facilitators. We were running that program. One of the things is as a member of the math science center network is I was recruiting some people around the state. I said, we should figure out a way to do this as a statewide program, send some of your teachers in. So they started to do that, some of my colleagues across the state.

Mike Gallagher (10:32):

And some of my colleagues said, we want to try to do over on the West side of the state, what you're doing in the Detroit area. So, can we pick your brain about that? And after a few sessions we decided to compete for another math science partnership grant that the state made available. So we built a statewide collaboration. So to your question, how have we affected the state? Is it was really about 2013 that we came together as a state. And we had partners in the upper peninsula, Northern Michigan, Western, Michigan, Southeast Michigan, all coming together to write a proposal. And we won our first grant and were able to offer six workshops in one summer, all over the state. So instead of it being a single workshop in a single region on a single topic like physics this gave us the platform to, first of all, be statewide. Second, that year we added chemistry. And then we actually just kept winning a series of grants from that particular source. And we you know, working on physics and chemistry teachers isn't enough. So we added biology and we added middle school in our second and third and you know, our big goal is to get earth science in, in there. And there's going to be a lot of work that has to happen between now and then for that, on that. But so we have the impact we've made on, first of all, you know, from your other podcasts. I think, you know, that when teachers go through in these workshops, they are transformed as professionals. We impact teacher retention at all levels, you know, and most of our insights are from anecdotes, but I know teachers who are just at the break of submitting their papers to retire, took a modeling workshop because some of their friends encouraged it and are still teaching 10 years later. I know 29 and 30 year olds who were doing what a lot of people do, planning to transition to a different career and finally realizing what they always wanted out of their teaching experience to impact students, to empower students, to help them realize that scientists for them,

because scientists belongs to everybody. It's just that our traditional systems convey a different message. We've impacted students because they, they come into a welcoming environment, modeling classrooms are explicitly and earnestly trying to work on a culture where people feel safe, exposing their reasoning to one another and to their teacher. And so those, so our teachers are recognizing that their students not just feel welcome, but they're thriving in their science classes. So some of the more profound examples are when a teacher goes back and they have a good relations with their colleagues and they're maybe have some similar philosophy and over the course of three or four years, one, two, and then all of those colleagues come to workshops. And then you have a student who's entering say a high school and only experiences science through modeling pedagogy their whole way through. So this isn't everywhere, but there are examples like West branch and up North in Roscommon and Gaillard some cities where some school districts, where every teacher is a modeling teacher. And then when we started to infiltrate the middle schools, some of those students are hitting it in middle school and then proceeding into to high school. So one of the things that's happened is we've had probably 1200 teachers who have taken modeling workshops in over a hundred different school districts. And we've you know, are we try to continue to improve and innovate? And one of them, of course, is offering second level workshops. So we have probably a hundred, 150 teachers who've gone through second level workshops in the state.

Mark Royce (14:51):

It's amazing to hear you sharing the amount of collaboration and coordination across your state. That's a pretty unusual, from my understanding, across the US to have one state who is so cohesive that way. Wow. I assume that your role is primarily coordinating that cooperation in your district area?

Mike Gallagher (15:20):

Yeah. You know, I serve especially Oakland County. The boundaries of our ISD are coincident with the boundary of our County, which is a square just outside of Detroit. So you know, I'm involved with many projects besides modeling, but probably modeling is my biggest, most successful project that I'm very strongly committed to, but we serve our districts with helping them adopt or design curriculum, with their professional development, we consult with them about their systems for supporting science, math, and STEM, computer science, K-12. So that's my service to our County. My County is best served when you know, the rising tide lifts all ships, the profession evolves, the profession establishes norms around the kind of teaching that modeling promulgates. And you you're right. Michigan is exceptional in some ways. We're first of all, exceptional that our legislature supported the math science center network for 25 years and now supports the, MiSTEM network. They support our ISDs. We just have great collegial, collaborative relationships in supporting many projects across the state, years of that. That positions us to compete for grants. Some of those grants are sometimes made available through the state. Sometimes they're federal funds. Now we're using MiSTEM council grants that require contributions from other MiSTEM regions to pool money, to create a consortia. So I think that is one thing, you know, our partnerships we include higher ed, like Eastern Michigan University is probably our most enduring partner with this grant, but we've had participation from faculty at University of Michigan and Grand Valley State University and Oakland University. AMTA is a huge partner. I mean, we couldn't do this without AMTA. When we started this, Mark, we had to import all of our facilitators from other places other than Don and Laura who were doing physics.

Mike Gallagher (17:36):

And those-- it was great teachers. They came in here and provided us with modeling workshops, became mentors for our Michigan teachers. When you write a math science partnership grant, you had to have a

sustainability plan. So one of our challenges was like, how are we going to grow our own facilitators? Because we need to be able to run these less expensively than flying people in and putting them in hotels, giving them a rental car for three weeks. We need Michigan-based facilitators. So our second year we started a project called the Aspiring Modeling Facilitators Academy and Don and Laura offered a week-long workshop for people. We got a lot of people who signed up for that too, by the way. We did a workshop in the summer, and then we positioned people as apprentices in our workshops. And we thought carefully about what that meant. It didn't mean that there were a TA going into the other room mixing chemicals. They actually had to have experiences practicing, facilitating, and leading. So now we have that network as well. It's a shared leadership among our facilitators. And then the people that you know, these various organizations

Mark Royce (18:58):

Does the AMTA still provide you with some instructors for workshops?

Mike Gallagher (19:03):

They do a number of things. I think we're kind of at a point now where all of our workshops could run with Michigan-based facilitators. Sometimes we still want to bring in some great people from other states, but another way they partner with us is our framework adaptations. So I think one of the other things that has made us successful and sustained a commitment to us is that we are committed to innovate, to improve and adapt. So another big windfall for us was adopting the next generation science standards. I don't know if you've talked about that at any length with any other podcasts.

Mark Royce (19:49):

We have, it comes up from time to time. Yes.

Mike Gallagher (19:52):

It's been great for modeling because we know at one level it's validated what modelers have been doing since the nineties, because you know, there's a little headwind when a teacher goes back and says, you know, I'm not going to be lecturing to students or giving them, you know, study guides with answers on them. I believe that they need to construct their own conclusions. There's a lot of headwind with administrators and other teachers, but the NGSS has really helped us validate. And you know, that kind of immersion experience for students where they're the NGSS, the vision is that students develop proficiency doing science. At the same time, it also created some constraints against modeling because the disciplinary core ideas, what we call the DCI's, are sometimes differently organized than they are in the modeling frameworks. In particular, biology.

Mike Gallagher (20:50):

So the AMTA helped us partner with redesigning biology to align to the next generation science standards. We started using a framework that significantly emphasized the concepts around classification when classification not only were not in the NGSS, they weren't even in our Michigan standards previous to the NGSS. So while it's brilliantly designed and part of the storyline, we had to figure out a way to serve what learning occurs through there, which is really about evolution, and do it in a way that serves the DCI's and the NGSS. And similarly, a lot of districts were shifting toward a physical science class because that's the way the next generation science standards were organized. And to accommodate that we worked with AMTA Colleen McGowan, initially, Rex Rice and Larry Dukerich, all got into that program. Phil Root, who was one of our chemistry mentors in the state, they helped us

work out a framework for a physical science class. We continue to work on that and improve it. And now we have physical science workshops. We still believe in that mechanics workshop because that's really the origin of it all. And it's particularly brilliant. The storyline that Larry Dukerich created for chemistry is -- I don't want to touch it. It's so amazing. And some people might take issue with some alignment issues, but I think we all embrace the idea of starting where the student is. And if the student is at unit zero, that's where we're starting with, and we're starting with unit zero and building their comprehension. That way we definitely depend on AMTA is a big partner.

Mark Royce (22:41):

My wife was a coauthor on the chemistry curriculum.

Mike Gallagher (22:44):

Oh, really?

Mark Royce (22:45):

Oh yeah. Brenda Royce. Yeah. She and Larry worked for quite a long time to developing it. Okay.

Mike Gallagher (22:53):

Well, I told some people at this podcast. They'd never heard of you, but they did know of Brenda.

Mark Royce (22:57):

Yeah, well, I'm not a science person. I've been involved in production and tech for years. And it's because of my wife that I started this podcast when I started realizing the impact that modeling has had, and the influence that she was finding, how it transforms a classroom. I thought, you know, we need to share this a little more.

Mike Gallagher (23:30):

Excellent. That's a huge contribution.

Mark Royce (23:33):

It's been really fun for me. I learn something every time. So that's great. So you said this: you said teachers do better when they can practice using a set of effective talk moves that achieved several important goals, clarity you know, expansion of ideas, listening to others, deeper reasoning, but can you kind of dig into that? What you mean when you say talk moves? I think that would be very interesting to understand.

Mike Gallagher (24:05):

I think that's really important. One of the things we... Okay, so this time you got to know what me, Mark. I think I might be in the Guinness book of records on this. I have been in and out of 46 different modeling workshops in the last decade. I don't know if there's anybody else who's visited as many modeling workshops. And it positions me to notice and cross-pollinate among a lot of different groups. So one of the first things I noticed is that there was a lot of different approaches to supporting discourse and talk in the classroom. And I had some some fluency in this because, you know, as I said, going back to my own methods class in 1991, 92, my professor used some version of talk moves and supported talk

and discourse. And then some of my colleagues, we had an interdisciplinary program once called my class where we, we had ELA, math, science, social studies.

Mike Gallagher (25:00):

And we used insights from the strategic literacy initiative, out in California. And one of them was resources around talk. And one of the things that we came away with after the first year is we need to have a standard across Michigan where every workshop participant gets the same benefit and the same level of quality facilitation, no matter which workshop they're in. The first year, we actually had three physics workshops and three chemistry workshops. So that's six different facilitators involved and you know what? They all brought their own kind of brilliance. And we learn from just gathering the eclectic approaches of people. But, but here's what I noticed in those earlier years is we were counting on something close to osmosis to, as a learning theory for how a teacher would go back and do talk moves with their kids.

Mike Gallagher (25:54):

Basically, we thought that the theory of change would be that they go immerse themselves into a well-facilitated experience. Then they can stand up and go back and do that with their students and what we found because we do every year, when you Saturday follow-ups with people, we bring people back together is they were trying, they believed in it, but they were struggling. And one of the benefits of the NGSS is some other people were doing homework on that out of Clark University, partnering with, with TERC in Massachusetts Sarah Michaels and Cathy O'Connor gathered what they saw with good teaching. And they organized something called the talk science primer. And as mentioned, it was organized around four goals and 13 talk moves, and they created this nice document and really what it was for us, It was a framework that we could use consistently across the state, and we could provide it to teachers so that they had something to anchor their beginning learning on.

Mike Gallagher (27:04):

You know and eventually people figure out their own way of doing things and they might drift and refine into a way that's very kind of personal for them that allows their identity to come through. But you got to start with some handholds. And what we did is we did a book study with the facilitators and one spring on the talk science primer and another book that we call the five practices. It's short for very long title. I think it's five practices for orchestrating productive talk in science. We use that book too, and we studied those books and we agreed that we would use those in our workshops. And we try to almost every year we've been able to do a facilitator retreat. So we kind of revisit these agreements we have, and we share resources and network and share innovations.

Mike Gallagher (28:00):

And so I think that's been super profound. And the good thing about NGSS is, it's all through also leaked through a number of other resources. I first encountered it through an NSTA webinar when soon after NGSS was created the NSTA, the National Science Teachers Association had these focus webinars and Sarah Michaels was on a webinar. And that's where I grabbed it. And then later there was a a professional development product called NGSX that Sarah Michaels was part of co-developing with Brian Riser at Northwestern University. It's a five day workshop it's amenable to modeling. The difference is it doesn't use a specific content that is the teachers are in there and they're going to necessarily teach that content. They, they focus on air pressure in particular. And it's great if you teach air pressure, but if you don't, you have to translate it to whatever you teach.

Mike Gallagher (28:55):

But the good thing about that workshop is it really forwards the talk science primer and the talk moves. So I think that's one of, we, we've got a long list of innovations that I think have improved our effectiveness and, you know, like going back to the aspiring modeling facilitators academy, I think we have really turbocharged the pace between when a teacher takes their first workshop to when they can become a effective facilitator. AMTA likes to hold a five-year standard, but I think they're ready to go in about three years because of things like using the talk science primer and the apprentice model that we have.

Mark Royce (29:37):

If you can send me links for those resources, if they can be shareable.

Mike Gallagher (29:43):

Absolutely.

Mark Royce (29:44):

We could, we could put them on our website at sciencemodelingtalks.com. And when people go to this episode on the site, there's a section that has resources available and so it makes them available to our listeners. That would be great.

Mike Gallagher (30:01):

Yeah, sure thing.

Mark Royce (30:03):

I'd like you to share some of the, just a few of the, the big tips, the big "ahas" and takeaways that you've discovered for use in the classroom. So I think that's always an interesting question to ask our guests and I think our listeners gain a lot from hearing, you know, that information, so share with us some tips for the classroom.

Mike Gallagher (30:32):

Okay. I, I would imagine from your other podcasts, some of these tips have already been aired, but one of the biggest ones is don't short the investment of time in building classroom culture. So building classroom culture -- there are a lot of ways to do it, and there's a lot of innovations that have come from the teachers that go back and use modeling and our facilitators, even in our workshops. So the students have to be ready to feel safe, to turn their brains inside out and expose their reasoning. You know, if a teacher is saying, say more about this, can you clarify what you're saying? What's your evidence? Those are our talk moves. It's very risky for students to be that, you know, safe. And so teachers have to invest in in a classroom culture that is is respectful, that is equitable and focused on reasoning.

Mike Gallagher (31:38):

Those ideas, those three principles actually come from Kathy O'Connor and Sarah Michaels and some of their talk science publications. And the other thing about that is don't think you're done. If you just spend the first couple of days doing that, or for some teachers, they might say it's, it's really two or three weeks or a month before they take on content really seriously, because if they short shrift the investment in culture, they have a tough year, all year long with students just withholding and not

talking. So visit it over and over again. We had a workshop -- we didn't run our normal workshops last summer because of COVID. But one of our physical science workshop in 2018 really lived into that. They did something about culture every single morning, pretty much throughout their whole three weeks.

Mike Gallagher (32:31):

And I would come in and just find, you know, I'm, I'm an outsider kind of coming in on these environments, but I just felt like I was at a family reunion or something by the second week. And, you know, I've never seen a group of people who could just find so much comedy in, you know, Newton's second law as this group could it's, so it really pays off. So that is one thing. Another thing, and this is something that we continue to work on, is if you're going to support a discourse session, some people call them a board meeting because we, we come to the, to a meeting in circle with two by three foot whiteboards and student groups have put their models on. As a facilitator leading that discussion, know where you're going. And in particular to use the language of the modeling cycle is understand what the target model is. The target model in most cases might be weeks in the development, but for this particular board meeting, you're building a component of that target model, know what it is and know where you're going so that your talk moves can you know, help shape the conversation, the student thinking, so that you can make sure they're anchoring their ideas and evidence and developing concepts that are toward that model. I would say also another one that relates to discourse and the support of discourse is when you're bringing students together for a discourse session, understand the purpose of that conversation. So it may sound like it's the same thing as the target model, but it's really a little different. So if we're starting a unit and we're going to just surface are our ideas. The purpose really is to surface our preconceived ideas about something.

Mike Gallagher (34:32):

And therefore your approach as a facilitator is going to be different than it might be later in the unit when you're working with evidence, or even later still, when you're developing a consensus around the driving question. So that first conversation you would refrain from ever correcting a student or refrain from challenging their ideas as much as trying to get the ideas to bounce across the room. And that's a different stance than when you just came out of the lab and you have a bunch of evidence. If a student is, is making a conclusion that doesn't align with the evidence well, you know, that needs to be something they contend with. So you might, you wouldn't say that they're wrong. You would just say, show me how the evidence supports your idea, you know, or you especially reach across the room, say, how would somebody else rephrase what that student said? Who can rephrase that and anchor into the evidence? And then the students might say, well, what they're saying is this, but I don't necessarily agree with that. So that move you wouldn't do when you're here at that first stage of surfacing our first ideas. That makes sense? So know the purpose of the conversation. Understand where you are in the modeling cycle and what the target model is. Those would be key things. Don't underestimate the investment in classroom culture, and don't think you're done with it.

Mark Royce (36:09):

Right. I had another little quote from you. And you mentioned the idea of back pocket questions. Share with us a little bit about that.

Mike Gallagher (36:20):

Yeah. So that is a phrase we use to mean as you plan that discourse session I mean, teachers would be able to advise to just wing it, right. To sit down, to not know where they're going to just see where the

conversation leads, because then, you know, then it's just becomes too unwieldy and unproductive. So one of the things that --a phenomenon that can happen is the conversation plateaus, the students are coming in, maybe they've got the model drawn, they've got data presented. They can talk about the model. They've gone to a certain level of conclusion and it's it's sound, but it's fairly basic. So the back pocket question is your strategy to deepen that conversation. So and here's one of the things that the NGSS has offered us is the cross cutting concepts. So the NGSS is organized into three dimensions. There's the knowledge dimension called the disciplinary core ideas, the science and engineering practices, which is how we do science, and the crosscutting concepts, which are cross cutting because they're universal. Every science uses these concepts. There's seven of them. One for example is patterns. One is cause and effect. Another is system models, equilibrium and change, those kinds of ideas. So a great place to get a back pocket question is drawing from those crosscutting concepts. That's not the only source, but you might say you might go a, like a deeper question about causation, you know, where you might say what is, you know, we've been talking about this experiment. Maybe it's a cart moving down a slope, but what is the system? How would we define the system? You know, and that's a, that's a little bit of a higher level question. You know, students are going to struggle with this and you kind of hope they do. You hope that there's a diversity of views out there, right? You know, or always add adding energy into it, you know, like you could have a fairly straightforward system you're looking at. It could be an ecological system, could be something in a Petri dish, right. And then you, and you throw in, where is the, is there, where's the energy involved in this? Is there, is there an energy transformation? Is there a source of energy? Is there energy emitted? And you know, modelers like to use what they call LOL diagrams to show account for how energy has changed. That's a back pocket question. Why not? You know, we've done some video of Don Patta's classroom and he's masterful at this. And one he might say is "Okay, we've got our data, but let's put some units on that data, you know, so go back..." Or "what is a function that describes that? What kind of function would describe that relationship?"

Mike Gallagher (39:20):

Because right now we're just looking at patterns in a graph, you know, but what happens if we put units on this? Sometimes it's like patently obvious or you'd think it would be. Other times it's kind of tricky, you know? And so the back pocket, you remember the third goal of the talk science primer is to deepen reasoning. So when we can predict that we're going to be at a plateau, let's push our reasoning a little bit deeper and give our kids confidence that, they can do science. Right. They can think deep about these things. Just got to give them a chance.

Mark Royce (39:54):

Yeah. Gosh, that's really great stuff. This has been fascinating for me. Mike, is there anything that you thought we might talk about that we haven't, or something that you would like to share with our listeners?

Mike Gallagher (40:11):

I did listen to David Heston is, and I never have met him. But you know, we stand on the shoulders of giants here in Michigan and what what Malcolm Wells and David created for us all is just incredible. I felt validated by listening to some things he said that that I think we have talked about in Michigan and feel are important. One of them is that one of the things he said is that teachers should be paid. I think one of the keys in Michigan, you know if I were to sum it up is that we're lucky to have that state funding, but we also have always, one of the reasons we've competed for such a large grants is because we want to pay teachers. We want, we want to support their travel. They're driving sometimes long distance. We

like to, years when we can pay mileage, we like to do that. We put them in hotels, sometimes a third or more of our teachers are in hotels for three weeks. And he talked about funding too. He was suggesting that funding needed to shift to the private sector rather than public funding. You know, he's competing for NSF grants. I partly agree with that, I think Michigan has benefited because we have committed... Our state has continuously committed funds for programs in Michigan. So I felt a strong agreement that they had more stable funding would make us better as a nation, you know, to invest in that. The other thing he said that was validating is the research they found about these workshops needed to be three weeks. And there are more like shorter workshops that are occurring because they get more teachers in the workshops. But I think if we were to pay them their full salaries, we wouldn't have problems getting teachers in and we wouldn't need to shorten workshops. There's no question in my mind. And our team in Michigan is that these, especially a first-level workshop, needs to be three weeks long. So you know, I would say those those tenants are really important. I don't know if there's anything particularly coherent about that, but

Mark Royce (42:38):

I think, you know, I've heard from others that it's been a little frustrating to have to shorten workshops, but the compromise comes out of the fact, like you mentioned, people can't afford to do it. There's not funding available from some districts to support teachers going to the workshops and things. So, but what you're saying is very, very valid. And so a big part of the challenge is to find the funding and to be able to resource teachers to participate.

Mike Gallagher (43:10):

Yeah. you know, that's where consortiums come in. Maybe there's some public funding. I guess one of the things that I would love this podcast to impact is other people wanting to instigate leads such programs. One thing that would be just really a wonderful and important is if the department of education, the federal department of education could restore funding that was focused on STEM. You know, they had the math-science partnership grants with no child left behind that were very productive. Before that they had Eisenhower funds, which I believe were mainly focused on science. Sometimes what they're doing now is they're lumping things into broader, broader categories. And then science education has a tougher time really having those kinds of focused, impactful programs. And similarly if states were to focus some significant funding, they took into account the need to compensate teachers and incentivize participation, and to build it systemically with that kind of long-term support, then these kinds of movements that were, that were experienced in Michigan could happen in other states.

Mark Royce (44:32):

Hmm. That'd be awesome.

Mike Gallagher (44:34):

Yep. I think that's really key. Higher ed is really critical. We were fortunate to have a great partner in the associate Dean in science education and physics education, Beth Kubitskey at Eastern Michigan University. She's been an enduring partner with us. She was actually offering some physics modeling workshops at her university. Now we're working with her this year to build a module that will be inserted this spring into her methods class at her university. And she's she's a leader across the state. So she has a voice with other methods teachers in all the universities across our state, and that resource will be shared with them. We've also talked about building out systems where pre-service teachers who are training to become teachers can come to modeling workshops with their cooperating teacher, or at

least the pathway into classrooms where the teacher who they're really being mentored by significantly in their student teaching is a modeling teacher, right? It's kind of a travesty for the universities to promote modeling and various forms of inquiry-based science only to have their teacher, their student teacher go in and, and accompany a teacher who is delivering content didactically and presenting content to kids and not using strategies we know are proven effective. It's kind of undermines the whole thing. Well, thanks. So our, you know, our partnerships with higher ed have tremendous potential to systematize what we're doing so that students arrive in the classroom more ready to go. One of the things about our programs is, we do applications; teachers apply to attend. And so we are looking at these profiles of teachers to make sure they're the teacher who's going to impact as many kids as possible. To do that, they have to have a job teaching in a district in the content of the workshop. If it's a biology workshop, they need to be teaching biology. We've had several young teachers. We've had open seats, so we bring in a young teacher and it's amazing to follow them over five years. First of all, they want to come to more workshops. And in five years, instead of being one of those teachers getting ready to transfer out of out of teaching, they're doubling down on their commitment, they're popular, they're successful. Yeah. So getting that induction, you know, that induction phase is kind of critical.

Mark Royce (47:18):

It brings them back to the reasons they wanted to teach in the first place.

Mike Gallagher (47:22):

Yeah. There you go. Exactly. And, you know, I can think of some faces of people who said that to us. Can I tell you about one other issue?

Mark Royce (47:29):

Sure.

Mike Gallagher (47:30):

So as we got a couple of years into doing our modeling in Michigan program from 2014 on we brought it into middle school, which was phenomenal for those teachers, we have a great movement around middle school. Simultaneously we had this middle school dilemma and that is middle school is a great band. So we offered a workshop in modeling in middle school science. We were addressing teachers who came from sixth, seventh, and eighth grade. You know, some of them only taught sixth grade, some teach all grades, they're all in different districts and they have different curricula. And, and what can we do in three weeks? We can really only do four units at most. Okay. And so we have to pick maybe a unit in physical science, a unit in biology, and a unit and Earth science maybe. And so those teachers, they thrive in the workshop, but when they go back and their teaching assignment is sixth grade, they might only get to use one of those four units that we shared with them. And that sort of undermines one of the big strengths of this program. And that is you you're immersed in units and materials that you get to take back to your classroom, right? Like if you're in chemistry, you're going to go through, you know, eight or nine units. Those are the exact same topics you teach in your classroom. You can use those exact units. So that's the middle-school dilemma. Now. We never had anybody complain in middle school. In fact, they are effusive in how our workshops have transferred, their sense of teaching and whatever they're working with. They figure out a way to modelize it and make it work for them. But one of the innovations that we struck upon is we partnered with a incredible problem-based NGSS-aligned curriculum called Mi-STAR. It's from the Michigan Technological University, Michigan Tech in the Upper Peninsula. And it's being used all over the state. In fact, in Oakland County, 18 or 19 of our 28 districts

are using Mi-STAR and in those districts are a lot of people who use modeling. So we advocate for that curriculum, but we also noted that if a modeling teacher's using the curriculum, they would do some, they would shift some things and do some things differently. So we established a partnership with Mi-STAR and started workshops that we call modeling with Mi-STAR. And the benefit of that is, well, we can have a sixth grade workshop or a seventh grade workshop. And every teacher who's coming from a Mi-STAR district is having full immersion in the very units that they will teach back when they go back to their classroom. Do you see the strength of that? Modeling with Mi-STAR. To get ready, we worked with the Mi-STAR curriculum team to modelize their units. So what does that mean? It's very interesting work, actually. First of all, their units are brilliant. They are all centered around a real-world 21st century challenge. Pandemic was one of the units. A pandemic scenario was built into their curriculum. Water quality, air quality, the built environment, all these things that our society is going to deal with anchor their units. They're called unit challenges. And then they start with surfacing the unit challenge, and they finish with doing something with the engineering standards to, to solve the unit challenge. And in between they do constructivist science learning. But one of the things that was missing from that is they they did not have the talk and discourse structured in to the degree that we would in a modeling workshop. They didn't necessarily use the modeling cycle or identify the target model. So when we modelized them... You know, we're still using their activities, but we might find that we need to be more specific about the target model, which is an important science concept. We might find that the storyline has too big of a leap from stage C to stage D. So we need to insert a new investigation. We definitely need to insert discourse and whiteboard sessions or board meetings. And they're wonderful to work with because they're just a learning organization like we are. They have a great platform to build upon, and they're wonderful to collaborate with. So our modeling leaders in middle school have been embarking on that, and we're kind of chipping away at modeling the, Mi-STAR units. We did one pilot in 2018 for sixth and seventh grade. And this summer, we're going to repeat that, moving to a different part of the state, and then we're going to add eighth grade. And then as the years go by, we hope to have a sixth grade workshop, seventh grade workshop, and an eighth grade workshop. And that's our solution to the middle-school dilemma. We're still this summer. We're hoping to, if we can be face-to-face, or one way or another, we're going to do it, but we're still going to have a modeling in middle school workshop for non-Mi-STAR teachers, because not everybody is a Mi-STAR district, but I it's just a fabulous collaboration that has just had wonderful success so far and more promising success down the road.

Mark Royce (52:56):

You guys are onto something that my wife and others have shared with me that is a problem. When teaching in high school, physics, chemistry, biology, and modeling approach. When you have students coming into ninth grade, that haven't had any exposure to a modeling-style instruction, it takes awhile to get them used to it, you know? And so to begin with the middle school. And so those kids are already in the flow of that kind of learning. It's really powerful.

Mike Gallagher (53:31):

Can you imagine being a biology teacher in 10th or 11th grade, and having a student walk in, who's been modeling since sixth grade. And, and you start your culture building and you say, okay, let's go this investigation, let's, let's develop our model, put your model on the whiteboard and let's have a conversation. We're already hearing about that. You know, we hear about it from high school teachers whose who students, even just for one year, went through modeling in middle school. And you know, they say, what do you notice? And they're just like popping out there. And I agree. I disagree. I'd like to

build on that. You know, they know how to do it and you know what they're doing? They're doing science. They're scientists.

Mark Royce (54:13):

Yeah. Right. Yeah. Gosh, it's awesome. Well, Mike, it has been really inspiring and enlightening to talk with you. So thank you so much for taking time out of your busy schedule to talk with us. It's been great.

Mike Gallagher (54:33):

Mark. You're a great contribution to our community with this. I poked through a few of your podcasts and it's creating some glue and mortar across the country to help to support us. I'm very appreciative.

Mark Royce (54:48):

Oh, thanks man. I really appreciate it.

Mike Gallagher (54:50):

Pretty soon. You're going to be as famous as Brenda.

Mark Royce (54:54):

Oh, I hope not. No, it's been great. Well we will, we'll talk again. I'm sure. And it would be fun to revisit some of the things that are happening in Michigan, again, with you in the future.

Mike Gallagher (55:11):

Cool. That'd be great. Take care.