



Science Modeling Talks

Episode 57 - Mike Vargas - “STEM Acceleration”

Guest: Mike Vargas

Mark Royce (02:19):

So, hello Michael. How are you?

Mike Vargas (02:22):

I'm doing good. Thanks for having me.

Mark Royce (02:24):

I'm glad you're here. Your bio is super impressive to me. All the stuff you've been doing. You've been teaching physics now for 20 years, you said? Is that right?

Mike Vargas (02:40):

Plus or minus? Yep. I did 10 years in Belgium, and we moved back in 2012, and then I did another 10 years back here in the valley. So, yeah, 20 years in the classroom roughly, all physics and loved every minute of it.

Mark Royce (02:59):

That's great. How did you first get introduced to modeling instruction?

Mike Vargas (03:06):

I started my career actually in Belgium. I'm originally from the Valley, here in Phoenix. It was 2003. I was looking for some extra help and I came home for the summer and a friend of mine recommended taking a modeling workshop. And I was like, what is modeling? What is this thing? So I took a class at ASU while I was home for the summer, and it totally just absolutely changed everything I had come to know and learn about physics and physics education and what I was doing. So I was a very early on adopter, let's put it that way.

Mark Royce (03:57):

What year was that?

Mike Vargas (03:58):

Gosh, I think it was like 2003. 2003. So almost 21 years ago.

Mark Royce (04:05):

Okay. So that was very early modeling adoption, so that's great. I know, because reading some things about you, you're a proponent of physics first in high school science course sequencing. So talk to us about why that is. So, why are you an advocate for physics first in the high school?

Mike Vargas (04:30):

Many years ago, there were some studies done about the current course sequence. There were some folks that broke from the norms and said, you know what? The way we're doing science is kind of crazy the way we have it siloed off. In fact, we probably shouldn't do-- because most schools do it this way. They do like a freshman science class of some type. Then they do bio, then they do chemistry. And then maybe you do physics if you're lucky. And physics first says, we shouldn't do any of that. We should do physics as the first class and not the last class. And it should be a freshman class, and then you should actually get into chemistry, and then you should actually be doing biochemistry junior year.

Mike Vargas (05:23):

And that should be the, the actual real sequence. The problem is nobody can actually pull that sequence off because of the way, you know, our entire system is formatted. So, you know, we're very siloed into bio, chemistry, physical sciences... Now, a little bit of sprinkle of engineering, maybe some earth and space if you're lucky, right? And so, that's a formula that doesn't really allow for the convergence of those different disciplines to blend together. Because the idea would be is that, what you should do is you should have the thread of energy kind of going through all of it. You should really start in middle school and have that energy thread going through all the way up through senior year, because you can tie that to all the sciences, right?

Mike Vargas (06:14):

When I first started learning about this many years ago, I was like, well, that makes sense. Why don't we change? Why don't we do this? But, you know, the way it works right now is it's, that's impossible because, you know, you know, new graduates graduate with a bio degree or a physics degree or a chemistry degree. There's no real blending, right? There's no real convergence of those disciplines. And so it makes that model very tough. The other thing too is that, trying to get someone that got their degree in physics to go to the freshman level and teach freshman physics is a very, very difficult proposition. Most folks that get their physics certificates, are like, well, I want the upper senior class honor students.

Mike Vargas (07:06):

And, and I have no interest in going down to the bottom and working with the freshman knuckleheads <laugh>, which is unfortunate because that's where I think the greatest need is. And you know, when I came to Pinnacle in 2012, we had this freshman first, model, that was just fantastic. It was awesome. And one of the advantages of going physics first with the freshmen is that, if you do it right, if you're doing physics first, right, you're teaching the kids all about the graphing, understanding the data, collecting the data, analyzing the data. It very data focused. And what happens is then, when testing season comes around, these kids can rock those standardized tests like nothing else because they know what they're looking at.

Mike Vargas (08:06):

They understand the X-Y axis, they understand what the line in the middle means, they understand what it is that you're asking me. So whether you're asking me a question about speed versus time, or fish versus crickets in a creek, right? <laugh>, because you have the ability to understand and interpret the graphs and know how to work with data, your test scores go through the roof. But because it's so hard to do that model, instead what happens is a lot of school districts will come in and be like, well, the science test is gonna be a bio test, we're gonna make sure the bio is happening the same year --that the kids are taking bio the same time they're taking that test and, so because of the way the sequences work out, the kids will oftentimes not even have access to the physics at all. You know, physics is tough. Physics is very hard because, as we've all come to learn and know the last couple years, there's two indicators if you're gonna go into a STEM degree, post high school. If you took a physics class and if you took a calculus class. Calculus a little bit less, but physics is like the number one thing you take. If you have that at any level too, freshman, sophomore, senior, AP --doesn't even matter what the level is. The data says that if I take that class before I graduate high school, my cognitive awareness of STEM careers in college like goes through the

roof.

Mike Vargas (09:46):

And I am more likely to do that. But, you know, trying to get physics teachers right now, of course is, it's tough. It's really hard because, you know, a lot of those folks that are teaching, it's a very tough proposition to say, Hey, would you like to give up that cushy senior level course or AP or whatever and go down to freshman science? A lot of folks really don't wanna do that. And so, freshman physics is tough. But I can tell you from my experience, every year when we were running this program at Pinnacle, we were top 10 in the state for public high schools. Our scores went through the roof. We had multiple kids just score through the roof on the standardized tests. It was because they knew how to do all the stuff necessary to interpret data and make those kind of analysis. I'm a big fan. I love freshman physics. I've done it for years. I'm its number one fan.

Mark Royce (10:58):

Yeah. That's awesome. I think it's a great thing to promote and more and more people seem to be adopting it, you know, it's pretty cool. You know, you just said it's hard to get physics teachers, and I know your context is in Arizona, and I know you mentioned, in some writing that I saw that, the Arizona Department of Education has a program called Get SET for STEM that has increased the number of physics teachers in the state. I think you said by like 20%, how many are actually now involved? How many teachers are after that increase, and is that enough in the state or where is it at for the state?

Mike Vargas (11:44):

So we're in full retreat. I wish I had some great stats to share, but-- so let me get into a little bit of teacher advocacy here. In 2014-15, a group of us physics teachers got together, and we were like, you know, we need to make a difference. We need to fix the condition in Arizona when it comes to physics education. At that point in time, there was about 159 of us with certificates left in the state. So, just think about it, right? 159 certificated physics teachers in the classroom for a state high school population of, hundreds of thousands, right? That math doesn't really work out too good for students. So your odds of getting a physics teacher or access to physics in general, were very low.

Mike Vargas (12:41):

And especially when you got to outlying districts, some of the further reaching rural districts, forget it, your chances of getting physics were negligible. So we went to the state, we lobbied the state legislature. We got a program called Get SET for STEM off the ground. And they brought some funds to help us get funding to teachers that wanted to get certified in something higher than their current status. So we've always known that it's a near impossible proposition to go get new physics teachers right out of college. I think Arizona last year with all four universities graduated three. So 3 kids total. Out of four universities to do all physics --that's as many as we got. Like that's pretty bad.

Mike Vargas (13:39):

So what is the next option? We gotta fill our ranks. What do we do? So this program was intended to bring up say like your eighth grade teacher, your ninth grade teacher who probably has a little bit of science background, but not nearly enough to feel comfortable to teach physics or chemistry or calculus or some of the harder courses. And we said, Hey, we'll pay for you to go get certified. We'll pay for you to take the classes. All we need you to do is to keep teaching, teach in Arizona for two to three more years after we give you these funds, and we will see what happens. And in about two to three years, we saw significant changes. We saw the physics teacher numbers went through the roof.

Mike Vargas (14:24):

I think we got almost close to 200 at one point in time, which was fantastic. That makes a huge difference. And so we felt pretty emboldened as a group of physics teachers doing public policy at the state capital. 'Cause you know, we're physics folks. I'm just gonna be honest, right? Like, we're usually the creatures of habit that hang out in the

far classroom at the end of the hallway that usually don't mix with anybody. And so the fact that we got all together and we're like, let's go do some public policy together, was pretty amazing. And then we called ourselves the Cactus Caucus and we just kind of got emboldened. We're like, let's just keep going. And we've been kind of all working together ever since, which has been pretty fun.

Mike Vargas (15:12):

And I think it's really made a difference across the state. That program sunsetted, I wanna say, four years ago, three years ago? A while ago, right before COVID. Vanished, and we thought, okay, the money's gone. Money's done, you know, it's finished. But, very exciting to report that there is a chance that the funding for Arizona teachers might happen again this next upcoming year, which we're pushing for and we're very excited about. 'cause we'll be able to hopefully get our numbers back up again. So, kind of did this, I know you can't see it 'cause we're on a, but basically we went almost up to 200 and we're doing pretty good. But then post-COVID, like really, crushed physics numbers and now we're down to almost like 135 ish, which is even less than we started with, which is kind of disappointing. But, but we're hoping that this action will be able to get those numbers back up again. Covid has been tough. It has affected science teacher numbers across the state. We're doing everything we can to try to get those numbers back up and bring more people into the profession.

Mark Royce (16:29):

Now you're kind of continuing that work, 'cause you're at ASU right now, working with the Arizona STEM Acceleration project, ASP. Tell me about that work and how it connects to the Get SET for STEM work that you did. How is the ASU project continuing network to develop new physics teachers or STEM teachers? What's the work you're doing all about?

Mike Vargas (16:59):

Alright, so how many hours we got? Just kidding. So ASAP, we have been talking about some kind of action to accelerate STEM across the state for years, like our whole group has. And so the Cactus Caucus wrote again, right in the middle of covid and basically, put in for a very large grant from ADE. And so we've been actually looking at like, well, what would it take to affect statewide systemic change? And to sum it up really quickly, that number's in the ballpark of about \$80 million to make a huge boost across the state. And so we told the state that, and they laughed at us and they thought, haha, you know, 80 million, yeah, that's never gonna happen.

Mike Vargas (17:57):

But when the Covid relief funds were released, they're like, well, we could give you 10. You think you do something with 10? We just kind of like, jaws dropped, of course. We're like, uh, yes. Uh, I think we could. Give us the --yes, give us a crack at it. So the idea here is that what we've done is we've created, a STEM education marketplace, whereas we have two groups working in sync with one another. So we have a coalition of professional development partners, we call our PD partners, that we are funding to basically do more STEM PD activities, stuff than they've ever done before. Some of these groups have never done STEM professional development. Some of these groups are some of our most veteran and seasoned statewide organizations. And what we've said to all of 'em is like we need you to bring teachers to the table and help them get better at their craft so that they can do better for their kids.

Mike Vargas (19:02):

And then on the other side, we have the teachers. We have about 411 teachers in the fellowship this year. We had 500 last year. And what they're doing is they are participating by kind of being the recipients of all that pd. So we've kind of created this synergy of this marketplace of mama birds and baby birds kind of feeding off each other and working together. And so the fellows are kind of voting with their footsteps, like what PD they want, and in response, the PD providers are providing the PD that the teachers want and need. And so that's really important because we're trying to incentivize organizations to start providing things that maybe they haven't done in the past. But also encouraging folks to do new kinds of content that's never been done before for the benefit of teachers that are in

the program.

Mike Vargas (19:58):

So the teachers themselves have three things that they have to do for the fellowship. Number one is they're doing STEM professional development. So they all have to commit to 30 hours of STEM pd. And the best part about it is they can pick. So there's nothing scripted here. The idea here is that you take what you need. So, if I'm a fifth grade teacher in central Phoenix, what I need for STEM looks very different than a physics teacher in the suburbs, right? And so we're not prescribing anything. We're not saying you have to go, I mean, I'm a physics guy, so I'm like, Hey, you guys should all go do quantum mechanics, right? But that fifth grade teacher's gonna laugh in my face and be like, no way am I signing up for that, right?

Mike Vargas (20:45):

But the idea here is that you pick what you want, you go get your 30 hours of PD in the subject area that you feel comfortable with, that you want to learn about. You know? 'cause heaven forbid you want to take PD that you wanna learn about, right? And then, they gotta do 30 hours by the end of the year. The second deliverable is they have to do a project with their students. That looks very different where you're at. So if you're a kindergarten teacher, you know, you're gonna have 20 kids maybe, its Arizona, so it's more like 35. Let me be real here. And you're gonna do a project with those kids in your school, right? And it could be whatever you want, whatever works for you.

Mike Vargas (21:30):

You know, we got high school teachers doing huge STEM nights with like a thousand kids. We got some groups with small groups of kids. It's all over the place, but it's orchestrated in a way that'll fit the needs of that community. 'Cause again, the fellows are preselected based upon geography, subject area, age group, and a whole other set of demographics. It wasn't like just everyone just, okay, you're great. You'd be great. We really tried to make sure that we have a very comprehensive map that encompasses the whole state so that we could get the max possible out of all the fellows in the project. So, PD, project with your kids. And the last thing is you gotta do, which we're very proud of, is you gotta do four lesson plans.

Mike Vargas (22:23):

So in the background, we're curating a website. It's STEM Teachers@asu.edu, and there's gonna be about 2000 lessons on here, at the end of the day. They're all curated, they're all made by teachers, for teachers. It's kinda like teachers pay teachers, but free, right? And anyone can have access to 'em. They're free. They have Arizona standards, they're geographically relevant. So there's a couple lessons in there for, maybe I'm gonna take the kids down to the Salt River to do a lab. There's a couple Salt River Labs in there. There's a couple for like the science center. There's a couple for some Arizona specific kind of content. So that Arizona teachers can take advantage of it.

Mark Royce (23:12):

Is that, are those resources gonna be available to people outside of Arizona? Teachers? Will it be valuable to outside of Arizona teachers?

Mike Vargas (23:22):

Oh, yeah. In fact, we got an email a couple weeks ago from someone from the Netherlands that was like, Hey, can I get some more of these? I mean, it was really kind of, I was like, wow, that's, that's pretty awesome. So, yeah, so, anyone anywhere can have access to these lessons and take advantage of 'em. The teachers retain the property rights to 'em. So, in the paperwork, it's their lesson. We are merely publicizing it for 'em. And so, you know, part of that also is to, a little efficacy, value proposition in there. And the fact that, we wanna get some of these teachers recognized for the good work they're doing, right?

Mike Vargas (24:09):

And some of these teachers are putting some amazing stuff and content up there. And so everyone's name is on their stuff. So people know that like, if this person did this amazing lesson, there it is. And, you know, and if I'm looking for a job or trying to get my name out there, I can always be like, yeah, my content is on the ASU STEM Teachers Phoenix website. Here, take a look. And there you go. And so we're working on that too.

Mark Royce (24:36):

Does the content that they're creating line up pretty well with modeling techniques?

Mike Vargas (24:41):

Oh, Yeah. We have a lot of modelers in the group. And some of the stuff that they're using...we've told them, look, you know, modeling is proprietary, right? So you gotta be careful with that. But a lot of our modelers have put content on there, which has been awesome. In fact, ASAP actually sponsors AMTA, like, we're actually, helping to support getting some middle school content off the ground, which has been pretty awesome. 'cause that's something I think we've all needed in the last couple years. What I think is really exciting about the whole lesson plan archive more than anything is that, you know, there's not a lot of free resources, especially in Arizona.

Mike Vargas (25:35):

Like, there's a lot of resources, but, you know, you gotta pay big bucks for it. And this is one of the few things that'll be out there for anybody. Take advantage of it, it's free. We've actually built it out so that it's all Google slide decks, so that all I have to do is take the Google slide deck and for a lot of these lessons, I can just put it up on the big screen with 15 minutes of prep in my classroom, and all the teacher notes are in there, and all the slides and all the pictures and all the things and the explanations to make it as teacher friendly as we possibly can. So teachers will implement it.

Mark Royce (26:13):

So, the AMTA people know about it so that they could maybe have a link or something on, on the AMTA site as well, be another way to pull in some more teachers to be able to enjoy that resource.

Mike Vargas (26:31):

Oh, Sure. Absolutely. We actually have-- so part of the coalition, we have 27 partners right now, and we have, about half a dozen, that have STEM fellows in their group that are doing nothing but working on content for that particular group. So, like, for example, the Arizona Department of Environmental Equality, Maricopa County STEM office, STEMazing, like they all have their own cohort, and a lot of those teachers are building content around that particular organization. And so a lot of these folks are building stuff that's like organizational specific, which I think is pretty awesome. So like, Arizona Education Foundation has their logo on it. And so we've been telling people like, Hey, if you wanna just put a lesson on there, do it 'cause we'll get it out to a lot of folks and we'll make it free access for anybody that wants to take advantage of it.

Mike Vargas (27:38):

And most importantly, also get the word out that, hey, your organization is doing these awesome lessons. I think that that's really important. 'cause a lot of folks don't know, you know what, especially like in middle school there, there's a lot of folks that don't know what modeling is. And so we're hoping to kind of get that word out that, you should check out some of this stuff. This is good stuff that you could use. And, you know, here, here you go. And here's an access point to get your feet wet. And, hopefully get you down the modeling pathway because, you know, I'm a modeler for 20 years now, and I can't say enough about how awesome it is and all the good stuff it does.

Mark Royce (28:22):

We're kind of running out of time here a little bit, but before we go, and by the way, this has been really great conversation with you. Can you share your best teaching or modeling tip with our listeners?

Mike Vargas (28:41):

Sure. I would say that, I took my first modeling course in 2003. And then I went back to Belgium, and there was no modelers in Belgium in 2003. I was the only one in the whole country. And it was hard. It was really tough. But a couple years later, when I started going back, I met other people that were modelers. And I think the thing that really helped me more than anything was that human connection with other people that were also learning how to model and learning how to teach through the modeling method, because you can go to the workshop, You can go, and you can participate and even multiple ones.

Mike Vargas (29:33):

But I really think that, my big tip for people is find someone else that is modeling and learn from them. That peer interface makes all the difference. I am probably the luckiest modeler ever because when I moved to Pinnacle back in 2012, I was there for a year or two, and lo and behold, guess who my next door neighbor is, is none other than Greg Swackhammer. And so Greg Swackhammer moves in, literally across the way from me and I'm still pretty young but man, I gotta tell you, I learned so much from that guy in the three years that we were at Pinnacle together, because, people know stuff.

Mike Vargas (30:24):

And especially I think with modeling, it's a craft. It is not something you learn overnight. It is something that takes time and dedication and learning from Swac was like one of the greatest experiences of my personal career because I mean, he taught me so much about not just the philosophy of it, but like, how do I lead the classroom into this physics concept? How do I get these kids engaged? I owe him my modeling career. I'll just put it out there. 'cause I learned so much from him just by watching him. And I mean, he was a massive influence. And for those guys out there out there who don't know who he is, he is the author of the Force Concept Inventory. He's that guy. And so, yes, I, I think I have like 15 years of those tests lying somewhere in my garage, even today. I keep saying I'm gonna do a paper on it, but I never do. So any rate, long story short, find someone that's modeling and learn from them. 'cause I think that's huge. That's absolutely huge.

Mark Royce (31:37):

That's really great. That is awesome. Well, man, it's been a pleasure talking with you. And the time has gone by so quickly. I would love to talk with you for another half hour. Gosh. Thank you so much for joining me.

Mike Vargas (31:59):

No worries.

Mark Royce (32:00):

And thank you for all the contributions you're making to our education system, Mike. It's really cool and I'm really glad there are people like you that are out there leading and it's really great. So, we're gonna post the transcript from this conversation on the Science Modeling Talks website, and any links or any of that kind of stuff that, that you've got, that you, we wanna share, we'll share 'em on the website as well. So, alright. Okay. So thank you so much for joining me.

Mike Vargas (32:38):

No, thank you. I appreciate it.

Mark Royce (32:40):

Okay. Take care.

