

## CERAMIC TECH CHAT

Episode 16

Title – “Teaching science through experience: Adelle Schade (E16)”

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### INTRO

De Guire: “I’m Eileen De Guire, and this is Ceramic Tech Chat.

In recent years, much attention has been given to the results of the Programme for International Student Assessment test, which is one of the biggest cross-national tests that measures reading ability, math and science literacy, and other skills among 15-year-olds in dozens of countries.

Since the assessment was first administered in 2000, performance of students in the United States has stayed fairly stable but relatively mediocre, and consistently lags behind other influential countries such as China and the United Kingdom.

This motivated many federal, state, and local agencies to look for ways to improve students’ STEM abilities. And one way is by changing the way in which science is taught, which is what the Science Research Institute is working to do.”

Schade: “The Science Research Institute is a nonprofit that focuses on K–12 education and teacher preparation for what we call ‘total experience learning,’ which is a personalized, inventive-based learning, and we have a fundamental background in this program in materials science.”

De Guire: “That’s Adelle Schade, dean of precollege and summer programs at Albright College in Pennsylvania and director of the Science Research Institute at Albright. Adelle started the Science Research Institute, or SRI, a little over six years ago at Conrad Weiser High School, where she was a teacher. Since its founding, more than 2,000 students have come through the program, and a year and a half ago, SRI expanded to Albright College to accommodate more students and teachers into the program.

So what does it take to develop a new education framework for teaching science to students? And how does the ‘total experience learning’ framework that Adelle mentioned work in practice?”

(music)

### SECTION 1

De Guire: “So, you started off your career teaching high school, is that right?”

Schade: “Correct. I was a high school and middle school teacher for 25 years before my move, which was about a year and a half ago to Albright College. And that move was prompted by the quick and massive expansion of SRI.”

De Guire: “Excellent. So can you tell us a little bit about how the Science Research Institute got started, and maybe as you do that, you can tie in your comment you just made about the fundamental aspect of materials science.”

Schade: “Sure. So SRI is what I call the Science Research Institute. And SRI started a little over six years ago one summer. Myself and twelve students decided to spend time in the summer working on research projects. And my background, the degrees that I have, are in biomedical research. So as we were looking some of the publishings and the literature, and my focus at that time was at the Rothman [Orthopaedic] Institute with Jefferson University, and we kept seeing bioactive glass material pop up in these publishings. And so we would talk as a group and say, ‘What is this? This is really fascinating.’ And then the more we learned about what that was, we were starting to make the connections between the materials that exist. And at that time, we were strictly looking at medical applications, although now in materials science and SRI has just exploded, but at that time we were starting to figure out that most of medical innovation had something to do with a material innovation and starting to really see that connection.”

De Guire: “Can you tell us a little bit about some of the materials science projects that have come up along the way? You mentioned bioglass. Maybe we could talk a little bit about that. Some of those projects.”

Schade: “Sure. There are so many. So when I said there’s 2,000 students in the program, there are 2,000 stories to tell because every student follows their own path. But one person who was a huge influence on this program was Ted Day. After that first summer and we started to see this bioactive glass terminology pop up in this company, Mo-Sci in Rolla [Missouri], we kept seeing that in the papers. What is this? Who is this? We as a group emailed Ted just out of the blue. We didn’t know him. And he got back to us right away, he had people from his company get back to us. And then right away, he said ‘I’m coming to visit. I want to see what you’re doing,’ because we asked for some samples of bioactive glass. And so, we had no idea that we asked for a very large amount of bioactive glass because we’d never worked with it before, which is why Ted came to Pennsylvania to see what we were doing. But after he had a chance to talk to the kids, he gave us all those bioactive glass samples, and that really just spurred all of this materials science research.

So we had students looking at nerve cell growth with bioactive glass, because we had cell culture capabilities, fluorescence imaging, all of those things. I had networked with business and industry to get these equipment pieces in so that we could do things that I was seeing in the big cities. And for those of you that don’t know, the high school I was at, Conrad Weiser in Robeson, Pa. [Pennsylvania], is in the middle of a farm field. So, there’s cows out of one side, horses in the back. And so how do we bring these big city opportunities there? We were looking at, what about, microorganisms infection. We could have lab-safe strands for this age group, but look at what would happen to those things

when bioactive glasses in the cell culture dish. We had many fruit fly studies because they're safe for high school and middle school. So our students got really good at dissecting fruit flies organs and microdissecting, and then would use those organs with bioactive glass studies. We had one student dissect fruit fly ovaries and injure them and place bioactive glass there. We had one student figure out a way to give fruit flies concussions on a vortex, would microdissect their brain, place some in bioactive glass, some not, and then we did some histology and stain for tau protein to see what happened with that concussion when it was treated versus not. You know, it's all these ideas that kids will come up with."

De Guire: "So you mentioned you had asked Ted for a large sample of bioglass. Have you used it all up yet?"

Schade: "No. I don't know. I think we have 50 years' worth of bioactive glass. He is an amazing man, so influential. He would visit SRI at least once a year, sometimes more. But he took really good care of us. We're set up for a while."

De Guire: "Right, so he was there at the very beginning, when you were just getting started. So it sounds like his influence was really kind of critical to launching SRI."

Schade: "Absolutely. And in many different ways. So there's the whole scientific collaboration, you know, the exposure to materials science, which I can tell you, even though I had already started my Ph.D. at that point, cell and molecular bio, I knew very little about materials science. My background before that was clinical microbiology and biology. So he kind of opened that world to me and to the students.

And then there was the other piece of Ted, who was a savvy businessman. And so he could also give me advice on how to grow SRI because I think he could see that it was unique and that it was really something that would be essential in education. You know, I think everyone understands that there needs to be some revolution in education. And so, his advice then on that side for SRI, it wouldn't be where it is today without that. He could talk to me about how do you scale this up? How do you network with other business and industry to support these kids? What kind of equipment should you be looking for? How do you put the safety procedures in place? I relied on Ted for a lot, a lot of that, much of that."

De Guire: "I know the program meant a great deal to him too, so that's great."

(music)

## SECTION 2

De Guire: "The response to SRI has been nothing short of phenomenal. You don't live in a large, urban area. So this is really impressive. What's different about SRI's approach from other STEM approaches that have been tried over the years?"

Schade: “So that’s a great question. I’ve been developing this method for about 10 years. About 10 years ago I started to commute from Reading, Pa., to Philadelphia, Pa., which is about an hour and a half commute. I wanted to see what was happening in R&D labs, I wanted to see what was happening in university research labs, and how could I create educational programming that would prepare our students for that. So looking at that bridge between K–12 to higher ed and then to business and industry. Because these three entities, much of the time, they work in silos. And we know that we rely on each other, but there’s very few times when we actually cross those borders and collaborate really well together. And so I was looking at this and thinking if I really wanted to make a difference, I needed to get myself in that environment to see and experience what was happening to be able to create the educational program.

And so as I started to do that, I could take what I was seeing students would need, which is the critical thinking skills, which is hands-on fundamental education and being able to innovate. Our neurological research shows that the most creative time of our brain is between the 5th and 10th grade. And so we need to do everything we can during that time to support creative and innovative educational thoughts and processes in our students. And then they’ll be successful when they go to the next level and they’re asked to do all that critical thinking because those things are skills, just like any skill, and the more you practice it, the better you get. So that was my focus. How do I support that, what do I do.

And I think what makes this program different is that every student that comes into the program is asked to create a plan, goals, a project, a prototype, wherever they want to go, in something they’re interested in. So we help them identify their passion and their interest, which really feeds motivation. And so, that personalized piece and then the inventive-type education is the key.

Some of what I was seeing as I was going and commuting to Philadelphia and watching some other K–12 programs is that they did a phenomenal job exposing students to careers and what was happening and doing activities in labs. But rarely did they give the students the chance to pursue what the student wanted. It was more of a, ‘Hey, if you’re going into this lab, this is what we do, and this is what you will do.’ And we’ve all been in that situation, getting our masters and PhDs, and ‘Hey, this is what’s happening.’ And so we flip that around to say, ‘What is this student interested in? What plan would they make?’ And then we find them the mentors and resources and support to follow the students’ passion. I would say that’s what makes it different.”

De Guire: “Very interesting. I had not realized that the sweet spot of our creativity is at such a young age. That’s a huge responsibility for those teachers in that age range.”

Schade: “Yes, and I think to learn how to support that so that it continues to foster and grow. Where I think in some traditional education systems, that’s the point they find where the motivation and the creativity starts to sink because it’s not supported.”

De Guire: “Is this a program that’s extracurricular, or is it built into the curriculum at the school when you first developed it?”

Schade: “Both. So students can participate in a variety of ways. That was another important pillar of this program. Our motto, our tagline is ‘Unleashing the genius that resides in every student.’ So, we do believe that any person that exists has something that they’re really good at, that they’re genius at, that they would excel at. It’s just a matter of finding what that thing is. And so there’s a variety of ways students can participate so that we don’t turn anybody away, which I think is really important at this age. We didn’t want a program that had all of these opportunities and then say, ‘Oh, well, but this group of students, you can’t access this.’ So open to everyone, flexible participation to work around schedules and parents’ schedules and all the demands of parents and students at this age. And we really want this to become something students enjoy and look forward to, and so that flexibility is important.

There’s courses they can take at some schools during the day. We just started a dual-enrollment program with Albright where juniors and seniors around the county can come and work in this and get college credit for it. There’s summer programs, there’s after-school programs, so there’s a variety of opportunities.”

De Guire: “And what makes a student successful in the program? So in other words, grades 5 through 10, some students are already starting to make decisions about themselves, like ‘I’m not good at math’ or ‘I don’t get science.’ How do you react to those kinds of internalizations in your program?”

Schade: “Right, I think, and that is such an important piece. And it’s something we intentionally developed program implementations to address that. So there’s a couple things again through the research that we know. One is at this age group, students need to see mentors and role models that reflect who they are. So they need to be able to believe that they can do something. The other thing these students need is a peer group that accepts who they are, and those goals that they have. So if you’re surrounded by your peers that all support this environment, being creative, being innovative, trying something out like the SRI environment, students tend to become comfortable with that self-image of who they are. And so those things are important. Surrounding them with peers, surrounding them with role models.

And in the SRI program, we have a scaffolded mentor system that happens. So we have students for the summer program, more towards the 5th, 6th grade age group, who may be in this for the first time. We match them up in interest areas with students who may have been in the program a couple years, so they get to walk around with them, talk with them, do skills with them. And then, above that, we have students in the older SRI age group, maybe 11th and 12th graders who have been in the program five and six years, who are also in these teams and help each other. They become a unit that is supportive of all these different levels. Above that we have college students who are also mentors of those teams, and above that, we have the high school teachers or college professors. So it moves from that level to the college kids to the high school, the middle school level, all in teams of interest, and I think that’s important. That’s when they get that sense of belonging and can actually see those role models in front of them.”

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## BREAK

De Guire: “The Ceramic and Glass Industry Foundation was established by The American Ceramic Society to inspire the next generation of ceramic and glass professionals. The CGIF has launched programs in student outreach, international student exchanges, a university-industry network, and its online Ceramic and Glass Career Center. Learn more about CGIF at [foundation.ceramics.org](http://foundation.ceramics.org).”

## SECTION 3

De Guire: “So you recently were awarded a nearly half million-dollar grant from the Pennsylvania Advancing Grant Program. Can you tell us a little bit about the goals of that grant and what that will enable you to do?”

Schade: “Sure, yeah. That is what they call PA Smart Advancing Grant, through the Pennsylvania Department of Education. And the goals of that are to really support STEM and computer science education in Pennsylvania, and to create innovative programming to do that. So they have to disperse these funds to a limited number of programs who could really show a new way of looking at things. And so what these funds are going to allow for in SRI is the support of low income and underserved student populations for the opportunity to participate in SRI. It covers any supply costs that we have for them, instructors, mentors, those types of things. So we’re going to be able to bring in little over 150 students through the next year and a half in all of our programming—summer, after school—be able to have them mentor with us through December of ’22.

The second piece of that grant is the students that are participating, we’re also going to be able to give professional development strategies and support to their teachers back in their home school district. So the teachers that are identified through this will be working with us side-by-side in the summer. We’re going to be able to go into their school buildings during the year and give them support during the school year, again for the next year and a half.”

De Guire: “It’s very exciting.”

Schade: “Thank you. It is, it is. And I think it, again, it takes away those barriers to opportunity, which I think are so important. So, being able to have that number of students. And to say low income in Pennsylvania, we use the national school lunch program of free and reduced lunch, and we’ll have students that will have access. You know, one of the things we do at SRI, for six years of existence, is find grant funding for any student that wouldn’t be able to afford some of our registration or membership fees. To find them the money so they can participate. At this point, we’ve never had to turn anyone away. And a huge piece of that through the last, I think it’s been five years, is the Ceramic and Glass Industry Foundation and ACerS members have also supported those students. And I think that’s

really important to say, that we've never had to have a student not have the funding so they couldn't participate."

De Guire: "That's wonderful. And that's exactly what the Foundation was established to do, is to encourage students—middle school, high school students—to give it a try. Knowledge is easy baggage to carry through life, so even if you figure out that through the experience that you're not destined to be a materials scientist, you know something about what's behind all the materials that you interact with every day."

Schade: "I'd love to say a thank you to CGIF and ACerS for all of their support through the evolution of SRI but also me as a professional. I can tell you, we're all in different professional organizations. This organization is so welcoming. Every time I go to a conference, I end up meeting new people or having people who are really pillars in ACerS make me feel welcome and introduce me to other people. And I just think, you know, again, with the experience with a lot of organizations, this one is very special, and I just want to say thank you."

De Guire: "Well thank you. I can tell you that that goes both ways. What you're doing at SRI is truly extraordinary and inspiring to all of us. Have you had any funny experiences working with students? That very creative age group?"

Schade: "Every day, every day. Oh my gosh. It's a lot of fun. I would say funniest would be hard to identify, but one thing that I thought was really funny and you'll appreciate. So, we had the Secretary of Agriculture for the State of Pennsylvania come to talk to the SRI students, and this was maybe three years ago. And he was walking around and looking at what the students were doing, and they were showing him all their experiments.

We have one group who had started to research a way to turn chicken manure into glass, which it actually works, and they now have five trade secret formulations on that. But what he told us, 'Hey, this chicken manure in Pennsylvania, it's the number one problem in agriculture. It's leaching into the Chesapeake. It's huge problem. Stay away from biofuels and fertilizer and figure out something else to do with it.' And so these students have been working with bioactive glass so much that they knew the chemical composition. They looked at the chemical composition of chicken manure, and it's almost identical. So they said, 'If these two things are kind of the same, shouldn't we be able to make glass out of that?' Well, we had some talks with Dr. Kathleen Richardson, who I'm sure many listening would know, and Dr. Casey Schwarz of Ursinus College, who are both ACerS members, right, and we met at MS&T. And so talking to these two brilliant women and like, 'Yeah, I mean, let's go for this, let's try this out.' We went to Ursinus and had the research furnace there and it works, and there's different formulations you can make.

So, Secretary Redding running came back, about a year and a half later, and we were showing him what happened. And, 'Hey, you asked us to do something innovative with chicken manure, and now we have this and it makes beautiful jewelry. Like you would be amazed at what this stuff looks like.' And he was talking to the crowd and said, 'These students, they're just not normal.' And you can see his face, then he was thinking, 'Should

I have said that?’ The kids loved it. They were just so laughing, and it became our tagline. So then all of our t-shirts on the back said ‘We’re not normal.’ They actually love that piece. So, I think that’s a funny story. It’s really not normal to think about glass with chicken manure, but it became our tagline.”

De Guire: “It’s a badge of honor. Well, I think that’s a great story. And it just goes to show that you have to think creatively about what your resources are and a lot of the problems we have, we just need to look at them from maybe a different angle. We naturally think of chicken manure as a problem, but here, they saw it as a resource. Well, kudos to them.”

Schade: “Right, yeah. And they just got together their first company that’s spurred out of SRI. It’s called Gallina Glass LLC. It has these five formulations, trade secret under the company, but it’s our first example for SRI of being able to develop glass business and industry out of the program. The young ladies who are doing that are now sophomore and junior in college.”

De Guire: “That’s excellent. And, tell them we look forward to being customers someday.”

(music)

## CONCLUSION

De Guire: “Not every student learns science in exactly the same way. But as the Science Research Institute shows, by giving students the opportunity to explore what interests them, you can unleash the genius that resides within each student.

I’m Eileen De Guire, and this is Ceramic Tech Chat.”

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Until next time, I’m Eileen De Guire, and thank you for joining us.”