



TECAID
Transforming Engineering Culture
To Advance Inclusion And Diversity

WEPAN
Women in Engineering ProActive Network

ASME
SETTING THE STANDARD

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ENGINEERING



Small Group Interview with Original TECAID PIs

This is a transcript of a small group interview of the original TECAID Principal Investigators [i.e., Diane Matt (WEPAN-PI); Tom Perry (ASME-co-PI); and Klod Kokini (Purdue College of Engineering-co-PI)]. Liz Litzler (TECAID evaluator from the University of Washington's Center for Evaluation & Research for STEM Equity (CERSE)) led the discussion.

[00:00:04]

Liz Litzler: Thank you all for being here today. We're very excited to talk about TECAID. I'm Liz Litzler and I'm the Director of the Center for Evaluation & Research for STEM Equity at the University of Washington. Tell us about you.

[00:00:19]

Diane Matt: I'm Diane Matt, acting as TECAID's Principal Investigator, and former Executive Director of Women in Engineering ProActive Network.

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Tom Perry: I'm Tom Perry, one the founding co-PIs of the TECAID grant in my role as Director of the Engineering Education with ASME.

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Klod Kokini: I'm Klod Kokini and I was one of the initial co-PIs as well, and I'm a professor of mechanical engineering at Purdue and Associate Dean for Academic Affairs in the College of Engineering.

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Liz Litzler: Wonderful. I feel very lucky to have the inaugural PIs of the TECAID project here. Tell me, what, what is TECAID? What is it all about?

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Diane Matt: TECAID is a National Science Foundation funded project that was aimed at preparing engineering faculty to lead cultural change within their mechanical engineering departments so that all students and all faculty could feel like they belonged and succeed in engineering.

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Klod Kokini: So TECAID stands for “Transforming Engineering Culture to Advance Inclusion and Diversity.”

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Liz Litzler: So what did you do in TECAID? What was it all about?

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Tom Perry: For me and for ASME it was about some of the fundamental necessities of culture evolution. Because of the evolution of the incoming student population, because of what we learned about what it takes to do engineering and the collaborative nature of engineering, and what it takes to really elicit the kinds of conversations and the kinds of ideas that really do produce innovation.

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Diane Matt: So let me build a little bit on what Tom said. When you think about the grand challenges that the National Academy of Engineering has identified, these are very big global problems; and many of them have a significant societal interface. So it's not just, it's not just equations, it's just not machines. All of them, if they're going to be solved; when you think about water supply for example, those are going to be problems that have a deep cultural significance that is different around the world. And what that means is in order to solve those problems people have to address the cultural needs of the populations that are being served by engineering solutions. And what that means is a whole different kind of inquiry and innovation than sometimes people are used to thinking about engineering doing.

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Diane Matt: So there's a big emphasis on being able to deliver solutions that are appropriate in different scenarios; and that's a different kind of thinking than often happens in engineering. What that means is you need to have many people around the table and when you do that what you get is sometimes great solutions; but what you also sometimes get is people disagreeing with each other.

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Diane Matt: And so part of what TECAID is intended to do is to engage that kind of diversity; that kind of cultural diversity, economic diversity, gender diversity, racial, ethnic diversity, all of those kinds of diversity; engage them in a productive way, in a collaborative way, to address the problems that the world faces. So that's part of

the importance of TECAID. Engineering isn't very able to do that right now; it's not experience that engineering faculties usually have.

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Liz Litzler: You said TECAID is all about preparing engineering faculty to do this change work around diversity, equity and inclusion. What did you do to prepare engineering faculty, or engineering departments including staff sometimes?

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Diane Matt: There were three big chunks that we wanted to achieve with TECAID; and I need you all to help me if I don't get this, don't hit this quite right. But one of them was knowledge about diversity, equity and inclusion. One of them was putting diversity, equity and inclusion knowledge to work. And the third was being able to understand how to build teams and lead change within an academic department. Academic higher engineering is a cornerstone of engineering. You can't do engineering without going through engineering programs.

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Klod Kokini: So I want to give a simpler context also related to the previous question. So in today's, at least in the US, today's colleges of engineering, if you look at the faculty distribution to use the example of women, are 85% male and 15% women. So by definition the 85% male population of engineering faculty defined what the culture is going to be. And that culture because of its definition is not very welcoming to individuals from underrepresented groups. And so a major component of TECAID was to try to take that majority group and try to provide education for them, so they could start understanding how what they're doing impacts those individuals from underrepresented groups, and therefore change the culture.

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Tom Perry: And engineering education itself is changing. There is an evolution that is happening that is moving much more towards collaborative work. There are advocacies that are taking hold that speak of design/build collaborative teams, all four years; sometimes called the design spine. And that's not just going off and thinking of the sort of problem that you want to calculate or that you want to put together or that you want to build a sample of; out of context of ultimately sorting out who does this help, who is it intended to help. And ultimately working in teams of students. And a significant part of this is helping faculty realize and understand and practice how to help diverse groups of students collaborate. It also has the very positive spinoff – actually it's not so much a spinoff but a core

issue – of how then these same kinds of principles support collaboration within a department, in our case mechanical engineering.

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Tom Perry: And these institutions and the departments of mechanical engineering are not hierarchal. There is a tremendous amount of expertise, tremendous amount of talent that comes together to make an engineering department. It is not an authoritarian structure. Collaboration is hugely important; and it's becoming increasingly diverse and yet still becomes even, needs to become even further diverse to reflect the population of students that are coming in, and reflect the multicultural aspects of global engineering, and the ideas that come from sources that you cannot see, that you won't know until you engage. So how do you engage? And teaching is not necessarily engaging. Mentoring is. How do you engage? It's teamwork; it's not just the old lecture anymore.

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Liz Litzler: So let me ask you about the components of TECAID. And I'm going to actually just sort of tell you some of those first and then maybe you can say them back to me. So I want to know what you did during TECAID to actually result in preparing these faculty. So that might include the workshops; that might include the VLC, which we call the Virtual Learning Community; that might including clinic-ing; we might speak to the role of experts. So can you tell me a little bit about the components of TECAID that resulted in the preparation that you know happened?

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Diane Matt: Sure.

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Klod Kokini: So we felt it was important, especially because these were engineering faculty, that they understand some of the social science components of how things like bias, micro aggressions, etcetera, work in an academic environment. And so we engaged outside subject matter experts that do scholarly work in this area, and had the experience of working with engineering faculty in their institutions. And so we engaged them to participate and organize four workshops, where all the participants of the five different mechanical engineering departments, as well as ourselves, you know participated and got fundamental education about many different topics that relate to this.

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Klod Kokini: So the VLC, the Virtual Learning Community that we organized, was related to bringing the group together and share from each other their own experiences. So the intent was to really build a community of participants, you know, and scholars.

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Diane Matt: Another key project element was really the fact that each of the department teams had to propose a project.

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Liz Litzler: Yes.

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Diane Matt: And that project was something that was always in the background during the workshops and during the Virtual Learning Communities. The teams were wrestling with that project and learning as they went how the learning that happened in the workshops and in the Virtual Learning Communities informed the work of their project, and how they maybe needed to think about it more, or expand it or shrink it or focus it in a different direction. So that was like an applied learning lab that they had going on, all the way along the year and a half that we worked with the teams.

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Diane Matt: Then the evaluation component was another key piece, and I know you're deeply involved in that. But always we were evaluating everything and reflecting that back to the teams, and letting them know what we were seeing that they had learned and interacting with them around those components.

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Klod Kokini: So our subject matter experts were also engaged with the teams in doing clinic-ing, which you mentioned, which involves, you know, having more one-to-one; questioning and understanding the things that they're maybe challenged with and some of the things they're successful with, and how to help them make headway in their projects, their engagement, their involvement, etcetera.

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Tom Perry: One of the things that encouraged me about this process; this is all voluntary. This is not – from the perspective of the departments, these weren't funded research publications types of projects. These were projects that – this became an opportunity. And it was exciting in fact that there were the number of institutions

that we had that submitted proposals. And we had to go through quite a process of sorting out proposals and so on. Department head leadership was required and manifested itself in all of the proposals. And so for us as advocates, as PIs on the project grant and so on; seeing the kind of response from the community gave us hope. Seeing that kind of responsibility –that kind of responsiveness to the opportunity to gather information, gather expertise, and have experience from a source that really had the research expertise and had that experience. The faculty themselves are experts in their own right. So credible resources, credible background, credible scientific and social science expertise was critical I think to getting the number of proposals that we had.

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Diane Matt: You know, Tom, you talked about the fact that our teams weren't paid. We covered their expenses but we didn't cover their time. So they had to want to do this work and I think that was actually a really smart decision that we made. And I have a little video in my head of something that happened; maybe it was about the third workshop and we had brought everybody together and our facilitators were in front of the room explaining some new concept. And I was sitting in the back of the room and I noticed that every single person in that room was sitting up in their seats, and they were really intent on what was going on up there. And I was like oh; not only did they volunteer for this, but now they've really kind of gotten engaged with it.

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Diane Matt: And that was an exciting moment that I have to remember about the project. Because they did have to stretch; the kind of learning we were asking people to do was you know outside the realm of technical topics. They were interpersonal topics; they were topics about culture, and they were topics about sensitivity, and they were topics about – I even laughed when people started using the empathy word in their conversations with each other. And you know we made it a little joke: oh my gosh, we have a room full of engineers talking about being empathic. That's a mark of success.

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Tom Perry: I think we did hear conversations change over the course of the project. Some of the experiences were slightly uncomfortable. Not hugely uncomfortable, but kind of a little queasy uncomfortable. And that was necessary; that kind of dissonance of an idea or a realization even in oneself that, “You know, I thought I was really doing the best that I could, but I still have some speed bumps that I didn't know about before.”

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Liz Litzler: Speaking of commitment and passion for this work, tell me a little bit about why you all got involved in this work; you and your organizations – why are you and your organizations involved and care about this work?

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Diane Matt: Well WEPAN came to this really as the lead on the project. And WEPAN has a big goal of 50/50 by 2050. And we know that the percentage of women in engineering has been hovering at 18, 19, 20 percent for a very, very long time. And so the idea here is we can't keep doing the same thing we've been doing; we have to come up with something different. And that is the culture; I mean that's – the feedback that we get from people who leave engineering is it's not a place where I felt like I could thrive. That's a pretty cultural statement. So we decided to tackle culture in engineering higher education.

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Diane Matt: You know there are many systemic things and many structural things that can be done. But when you start talking about the way people value each other's input, and the way they listen to each other with respect; those are different kinds of skills that aren't always in the forefront in academia. So in order for students to thrive and for those numbers to change; and the numbers for underrepresented minorities are even worse. But that's the future of our industry and of our educational operation. The students today in kindergarten are 40% students of color, and that's not the way engineering looks. So we have to get better as a field at recruiting, attracting, retaining those students.

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Tom Perry: And on the recruiting side; I often go back to just the simple thought that was told to me by a middle school teacher in D.C., in one of the District of Columbia middle schools, intermediate schools. And that was if you can't see it you can't be it. To which I add from an engineering standpoint; if you've never seen it, you can't fix it. Because it's not just about what happens in the laboratory and what happens in the research; although that's critically and pivotally important, otherwise you'd never go anywhere. But beyond that it's what happens on the ground with real people, real situations. And it's creativity beforehand, it might be an innovative process; but innovation doesn't happen until it becomes real and someone else does it, not just you.

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Klod Kokini: I just want to add a quick thing. So from Purdue's perspective we've had our faculty participate in workshops in the past. And so when Diane Matt started leading this project and putting together the proposal and we talked about it, I felt – you know I was bringing – I would be able to bring a good perspective from Purdue's experience; you know with faculty's engagement and some of the things that we heard from alumni, you know, related to this. And so I think it made a very nice collaboration you know for all three institutions to be engaged.

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Diane Matt: Can I say, the thing that drew me to ASME was the fact that Tom Perry's group had a diversity goal within that organization.

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Tom Perry: Officially.

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Diane Matt: Officially. Approved, sanctioned, thumb printed, the whole thing. And that meant that he could stretch a little bit further as an organization and help lead this. So we had a leader from higher education, we had a diversity organization, and we had a technical engineering society.

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Liz Litzler: Perfect. I'm going to try and move us along because I'm realizing that our time is short here. My next question is, “What did you all learn from participating in this project?” So in addition to being PIs and leading the project, you also participated in all the workshops and were there learning along with the teams. What kinds of things did you learn?

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Klod Kokini: Well I have to say probably the thing that most impacted me is the role of conflict or what we call dissonance, constructive dissonance. So traditionally you know we always think of conflict as a bad thing, that's something we should avoid, we should stay away from. And some of the things that we learned during this work was that conflict or dissonance doesn't have to be bad; and actually engaging it in a positive way, in a constructive way, can lead to change. In fact you know some of the things learn says that you need to have dissonance to really be able to have change occur.

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Tom Perry: Well it's interesting; it aligns exactly with what engineers do and are supposed to do. And that is to take things that are as they are and make them different on purpose. And so that dissatisfaction with the status quo is key in the practice of engineering, in the work of engineering as a profession. And it would seem that this dissonance then in the cases that we created with the teams and so on probably shouldn't have been, felt as awkward as it did; but it's a bandwidth of dissonance, an area of dissonance that we're not used to. We're used to other kinds of change, and so getting used to this kind of change as engineers is a little bit different.

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Diane Matt: This interpersonal kind of thing. I focus on the role of core teams and expanded teams here. You know we started out with five teams from a department that had to include senior faculty and the department chair. And then several teams expanded that to others on their campus; and sometimes they would use resource centers that were you know quite renowned on their campus to help them with their diversity, equity and inclusion learning. Others leveraged other kinds of funded projects. Some found experts that they could use as consultants. I think a thing to bear in mind is that diversity, equity and inclusion; they permeate every aspect of everything that we do. And so finding experts and finding knowledge that are outside your immediate group are really a huge help; and the most successful teams did that well.

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Liz Litzler: And you know this work is hard, right? The work around making culture change in engineering; making culture change in academia is hard. What challenges do you know exist out there, and how would you – what challenges will people face if they want to do this work? And how should they try to overcome those?

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Diane Matt: Well to pick up on I think the topic that Tom raised about noticing when something isn't quite the way you would like it to be, and starting to think about how it might be improved. Some of that extends to the mindset that you bring to the environment you work in, the environment that you educate in. And all of us have a set of you know commonly accepted truths about what we do. And another way to look at those commonly accepted truths is to ask yourself whether or not they're biases. You know, “Do I think that the only people who can succeed in such-and-such are these kind of people?” “Do I think that the only evidence of success is you know this kind of a grade?” “What else could be a

determinant of success?” “How could this be shaped differently?” So I think almost, almost everything in an academic setting, those kinds of questions could be asked; and say, “How is this working for us?” “How is this not working for us?” “Could it work better?”

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Klod Kokini: One of the biggest challenges that most teams faced, and which is pretty typical, is resistance. So when the teams would come to the workshops and go back and talk to their colleagues about these issues, you know their colleagues would always find reasons why they should not be doing it, or why it doesn't, you know. And you know in other contexts we hear things like are you trying to lower quality by emphasizing diversity, etcetera? And so, you know, we think that we gave them tools to try to deal, you know, with some of those issues; both with each other, with the subject matter experts, etcetera.

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Diane Matt: To see things from another perspective.

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Liz Litzler: Any other challenges that you want to reference, that you have ideas for how they can be overcome?

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Tom Perry: There's the usual challenge of time. And it's particularly evident in mechanical engineering right now because the enrollments are so large and the classes are so large and so on. And as you move towards more collaborative student work, that takes more time to teach and mentor that. And the research challenges and demands are there. It's hugely important; even at a public policy level to have publically funded research is magnificently important to the evolution of society, the evolution of culture, planetary evolution, all of that. But anyway, trying to carve time for – even if you have the interest is difficult. So getting collaborators – you can't do it all – getting collaborators within the department to give some persistence to the passion is really, really important. And beginning to see these issues from a teaching and mentoring standpoint; beginning to see it – and I know we don't often do a good job with this, but it's infrastructure. And maintaining the infrastructure, advancing the infrastructure of an academic environment is core level; really it is. So the results are long term.

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Diane Matt: And the effort, I think, has to extend over time as well. You know there will be incremental changes, there will be bigger jumps, there will be setbacks; and then there will be some renewing, kind of inspiration that comes from a partner that you engaged some time ago; or someone that you met that sees some overlap with what you're doing, that brings a new angle, a new initiative, perhaps new resources whether those are intellectual or otherwise to help solve a problem or advance an issue.

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Tom Perry: And you know even the results can be short term. Because those of us who got into teaching didn't do so because we were antisocial. We did so because we wanted to give back; because we wanted to nurture, because we wanted to engage. I've found in this process the short term results are in much richer engagement; and learning, "Wow! Really? I didn't know that." And as learners, as mentors, the, "Wow, I didn't know that!" don't we live for that?

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Liz Litzler: Sounds amazing, right?

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Diane Matt: Sounds like intrinsic payoff, Tom.

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Tom Perry: Okay. Yes it does.

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Klod Kokini: So at the same time, many times this kind of work there is an effort to boil it down to numbers. You know, how many more women do we have in terms of students, or how many more underrepresented minorities? And this kind of work requires a much longer term engagement. You know those numbers do not change very quickly, and culture doesn't change very quickly. And so I think it's important to give tools to those who are interested and engaged, to continue to do the work, you know, even if the numbers don't change right away.

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Liz Litzler: Perfect segue, Klod; thank you. Tools. What kind of tools or resources does TECAID have to help academic departments who are interested in making culture change around diversity, equity and inclusion?

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Diane Matt: TECAID has produced some case studies that are drawn from our experience with the project. There are three of them and they look at different aspects of the learning that we gained. So those will be useful to people as they want to gain more insight into how the project evolved and what different teams experienced. So that's one important resource. There's also a change model that explains from an overview perspective what the major stages were in the project. And there's drill down materials for each stage of the change model.

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Tom Perry: I particularly like the model, because I'm an engineer. I like models; I'm a mechanical engineer. I can see things upside down, backwards and inside out. And seeing that model puts things in context.

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Diane Matt: It does.

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Liz Litzler: And my understanding is that this model is very iterative. So there's a sense of like you can enter at any place in the model and sort of work on building your team at the same time that you might be thinking about learning more information about diversity, equity and inclusion.

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Diane Matt: In fact I think about it in a 3D way.

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Tom Perry: Oh good!

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Diane Matt: It's iterative among the different stages in the model, and then it needs to iterate again and again. And hopefully it becomes a spiral for increasing knowledge, increasing feelings of confidence and competence, and increasingly re-norming the culture to something that everyone can be successful in.

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Liz Litzler: In your opinion, what else needs to happen to improve the experiences of underrepresented groups in engineering and mechanical engineering? There's so much work to do. What do we need to do?

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Klod Kokini: So there's a lot of work ahead. You know, I think we're really you know bringing to some extent a component; we think it's a new component because it specifically focuses on faculty and faculty leadership groups, and explores the possibility of collaboration. But you know one of the things that we have recommended to all the teams is to indeed find resources on their campus to continue the work in a way that starts yielding results that go beyond what they've achieved so far.

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Klod Kokini: So they need to continue to learn. They need to continue to work together and create a community. They need to put it into action, you know. And sometimes as they, the teams themselves have determined, some of these actions may result in small victories and they need to celebrate that. In some other cases they may not yield big results, and that's okay. You just keep – you know they kept talking about, “Think big, act small,” I think, was the thing that they determined. So you know it's very – the most important thing is persistence and just keep working.

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Diane Matt: If I had a wand, I would hope that many Deans of Engineering and many department chairs would engage in thinking much more about diversity, equity and inclusion with the intention to shape that better in their institutions. I think this kind of an effort needs that leadership from the top. It also needs the kind of commitment that faculty can bring to it. Unfortunately it's not a one-stop shop kind of thing. There needs to be much activity at many levels and leadership is really important.

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Tom Perry: Yeah, as a college, as a department, square one is to put it on the table and never take it off.

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Diane Matt: Keep nudging it back to the middle.

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Tom Perry: Absolutely. And that word inclusion is huge. That concept of inclusion is huge. Frankly you don't actually need a diverse environment to practice and get the best out of inclusion principles. But you need that inclusion in order to increasingly diversify your environment. And the – with schedules, with work pressures and so on, sometimes we cut inclusive practices short. And we do so at our peril in the long run; because the ideas don't come out. And there are – in fact I might

even cite it at this point; there is just a little bit of writing called the Abilene – let me think of it; the Abilene Paradox. And it's a little story about a family – I apologize for not remembering who wrote it. A little story about a family, a three generations family decided to go to Abilene for dinner; they lived about 50 miles outside of Abilene. Everybody agreed around the Sunday afternoon front porch, yeah, let's go to Abilene for dinner. On the way back after they did that, people tired and so on, somebody said something. And one by one by one they all decided to go to Abilene, but nobody individually really wanted to go.

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Tom Perry: And in environments that are so collaboratively oriented, like department faculties and so on in many ways; to have, to make sure using inclusive practices, to make sure that the environment is such that, and the outreach, the handout is such that if you have an issue you speak to it; and it is heard and it's reflected and it is understood by everybody at the table before you all decide to do something. It's hugely important and it works in design teams as well for students.

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Liz Litzler: What else do you want to tell me about TECAID that you haven't described yet?

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Diane Matt: I think that TECAID was an amazing, an amazing project. We had twenty-five people who stuck with it for eighteen months, went through an entirely different kind of learning together. And the stats that we got are fascinating to look at. You know the degree to which people felt like they now understood diversity, equity and inclusion compared to where they start, started. The fact that they felt comfortable talking to their colleagues about it. The fact that they were willing to take action within the context of their departments, sometimes within their universities. So on every measure people made progress. And you know they're willing to come to this conference [2017 Women in Engineering ProActive Network Change Leader Forum] and talk about it now. So I think we engaged them in some different ways than they typically are engaged, and my hope is that they'll continue working on these issues into the future.

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Klod Kokini: And I think it does represent a model which has been evaluated, you know, and shown to be effective. And maybe not everybody can do it in the same way, I mean, again, resources are always too short and too few. However, it does create a road map for anybody who really wants to engage in a change project that involves diversity, equity and inclusion; to use this model as a way to at least

start. You know, it may take them in different directions, but certainly this will be a great way you know to start navigating this journey.

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Liz Litzler: Thank you so much for your time today. If you have any last thoughts about TECAID we'd love to hear those, and go right ahead.

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Tom Perry: It's shown those of us at ASME that there, that the faculty and mechanical engineering departments are interested, are responsive; our collaboration with WEPAN has been fabulous. The expertise they have brought to the table has been fabulous. And so we are encouraged, hopeful, and are planning to stick with it for sure. It's not coming off our table.

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Liz Litzler: Wonderful.

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Diane Matt: That's great. What I'll say is I have enjoyed working with all of you on this. Since the days that we prepared the proposal it has been a wonderful team effort. Thank you all for bringing everything to the table that you brought to the table; inspiration, ideas, expertise, support.

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Klod Kokini: And I want to echo that. I feel that, you know, many of us over this entire – including the teams and many members of the teams. I think, you know, most participants have really grown beyond just a project that they did professionally. I think people have bonded together in indescribable ways, and I imagine this will last for a long time. And I'm hoping very much that you know anybody else who undertakes such a thing will move along the same directions.

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Liz Litzler: Wonderful. Thank you for those thoughts and thank you for your time.

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All: Thank you.