

An Engineering Graduating Class of 56% Female Students

Interviewer: Donna Milgram, Executive Director, Institute for Women in Trades, Technology & Science (IWITTS)

Guest Presenter: Dr. Elizabeth Orwin, Professor of Engineering and Department Chair and Director of the Engman Fellowship Program in Bioengineering at Harvey Mudd College

Interview Transcript:

Donna: Hello and welcome! My name is Donna Milgram, Executive Director of the Institute for Women in Trades, Technology and Science, and I am so excited to welcome you to this session of the *STEM Success for Women Telesummit*, funded by the National Science Foundation. We'll have an interview with a very special guest.

Our guest today is Dr. Elizabeth Orwin, Professor of Engineering and Department Chair and Director of the Engman Fellowship Program in Bioengineering at Harvey Mudd College. Since receiving her Ph.D. in biomedical engineering from the University of Minnesota, Dr. Orwin has worked on several research projects in wound healing and medical device design, including the development of a tissue-engineered corneal replacement. Harvey Mudd College, where Dr. Orwin is the Engineering Department Chair, made national news when **last year's graduating class of engineering students was 56% female**. What a milestone!



Dr. Elizabeth Orwin

Welcome, Liz, and thank you for joining me for the STEM Success for Women Telesummit.

Dr. Elizabeth Orwin (Liz): Thank you, Donna, and thank you for having me.

Donna: Well, I want to start out by asking you, Liz, if maybe you can tell us why you feel it's important to have more female students in engineering.

Liz: Great, sure. I think it's important that our program and engineering, in general, is reflective of the general population. That all people, women and men and everybody feel welcome to pursue a career in this field. I also think it's really important that we break down the gender stereotypes that maybe women aren't as capable as engineers or not as inclined or whatever. We've all heard these kinds of things. I think when we acquiesce to think this kind of thing, we're losing a lot of talent. I think it's really important that there is access in this field.

Donna: It's so wonderful to see how Harvey Mudd has done this! **I wonder if you can tell me in a little more detail about the number of females that you have graduating with engineering degrees, what percentage and what kind of numbers?**

Liz: Sure. I can say that if you look at the data over the last ten years, **engineering at Harvey Mudd has fluctuated to anywhere as low as 24% in the ten-ish years ago to up to 56% in the last year or so**. We go up and down. I would say we are stabilizing in the mid-40%, lately. That's been a really big deal for us.

In that same time period, the percentage of women in the college has steadily increased from about 30% to about 46%. **Last year was really a historic moment for us. With over 50% graduating engineers as women – that was a really big deal.** As a former student of this program, I can tell you that for me personally that was a really good moment.

Donna: Wow that is amazing **because nationally, the percentage of women receiving bachelor's degree in engineering is only 19%.** So that is really a huge difference from the national average. I wonder if you can tell us about any kind of changes that have been made since the earlier years when the percentages were smaller, still above the national average, but more along the lines of as you were saying 25-26%. **Were there intentional types of changes that were made that helped this? Could you talk about that and also maybe talk a little bit about Harvey Mudd itself as a school?**

Liz: Sure, let me start with that last part. Let me talk about Harvey Mudd; I think it would give context for the rest of my comments. Harvey Mudd is a sort of unique place, and I'm going to call it "lucky" a little bit on this front because we're a small school. All science and engineering and math majors, but the mission of the college is all about impact of our work on society. In going along with that, at Harvey Mudd, we have an honor code and a stated goal that a third of the curriculum that the students will take will be in the humanities, social sciences and the arts. So I think just right there, the college's mission and value on things other than science and broadly educating somebody is a place that is attractive to women, especially women who are interested in the rigorous technical degree, but might want other, broader things than that. I think we're a little bit of a unique place for that.

Donna: I think that you are. That's so interesting that you're a college that focuses on science and math and technology, yet you also have as part of your mission and commitment the impact of your work on society.

Liz: Yeah.

Donna: I'm wondering if there are other colleges that are similar, to your knowledge, because that is really a powerful combination.

Liz: Actually, I haven't found any place, there are places that have pieces of what we do and then other pieces that we don't have. I think we have the unique combination of that impact and mission piece, which really does permeate to the entire academic and non-academic side of campus. With that sort of technical rigor of the program, it's an interesting place and it's evolved into where it is. I think one of the other pieces of Harvey Mudd that goes with the honor code is community. That is important here. One piece of that is the student body is very small. It's a place where women can feel supported. It's a nice, close-knit community. It is one of the things that attracted me as a student, I will say.

Let me mention one more thing, kind of as a background. We have a female president, Maria Klawe, who came in a number of years ago, ten-ish years ago. One of her stated goals was to increase the number of women at the college. She worked hard on that. I think that is an important piece, a backdrop, to what we have done in engineering. Like I said, we sort of fell into some of it with her and her recruiting efforts as well as the efforts on the part of the admissions department to really go out

there and attract qualified women to come here. And the last thing that we wanted to do and that she wanted to do, originally, is to bring in women that were going to struggle here. Then you have the whole backlash of women aren't really inclined for this stuff anyway, right? That was really a very difficult task to do and she has managed to do it. It has been a steady increase over the last ten years. I think that is all a backdrop to what has happened within the engineering department here.

Back to the curricular things that we've done that I think has had an impact, some of it at the beginning were inadvertent. It wasn't necessarily stated; it wasn't like we sat there and said, "We are going to increase more women, so we are going to do this." It was like, we did this and then we began to realize that this was particularly impactful for women and capitalized on that. So I would say it's more the second.

In the mid-90s, we took our introductory design course, which is traditionally a freshmen-level course from a pure lecture format to what we call a studio format. The studio format is all about learning by doing. We had the students come in, there are circular tables, they work in teams, they try something, they work together, they do an exercise at the board, maybe take something apart, they try it, we talk about it, they try it again. So it's more hands-on focus than the prior approach to that course.

I think this is really powerful and really impactful, particularly for women. I think the hands-on approach is key. **It builds confidence in all students, and I think that confidence is particularly powerful for women.** I think what happens is, they may have been told "Well, women aren't as good at this and "A girl can't do science", "Girls aren't good at math" or whatever they hear, whatever the societal messages are. They come in here and they have this "I can do this" moment. I just did it! Right? It's sort of baby steps in working at their confidence and I think that's hugely powerful for women.

Donna: So interesting. There are so many things that I want to discuss from what you've been talking about. First of all, you of course have the perspective of someone who was a student prior to these changes. It's interesting that you tell me that really what you did at Harvey Mudd in the mid-90s was to experiment to come up with what worked. Of course, I mean part of engineering is experimentation, so that was the approach. One of the things you discovered was being hands-on was really a big confidence-builder for your female students in particular, and having that be something up front.

Other studies show that confidence is a big predictor of success for female students. So one of the things that we recommend in the [WomenTech Educators Training](#) that I designed, and that we provide to schools, is that on the very first day to make sure that they have to design something that is a hands-on activity that will give the female students—and the male students, too—a feeling of confidence that they are going to be able to do this. It also gives them a contextual, hands-on experience. It's so interesting that your experimentation came up with this in the mid-90s and that's been an important component of what you do.

Liz: Yeah.

Donna: The few things that you talked about that are part of Harvey Mudd College's fabric, so to speak, are things that I think are good lessons for our listeners, even if they won't be at Harvey Mudd. First,

your president is providing top-down leadership on this. That is really important. I have been following her at Harvey Mudd College and I think that this is a big driver. **I wondered if you could talk a little bit more in terms of her leadership.**

Liz: Sure. I think basically what happened, like you said, Maria came in and said, “This is a priority; this is important.” These are hard problems. It’s hard to sit there and say, “I wonder why we are turning away women or why aren’t we supporting them as much?” I think that the important first step is to recognize that this is an issue that we should try to tackle. I think it’s hard to get started because you can’t really imagine how you are going to fix it. You don’t feel like you have all the tools. You need somebody to come in or a decision to be made that says we are going to tackle this. Then people can start imagining smaller ways. Instead of having it be this big mountain, it’s how are we going to start chipping away? What she managed to do is say, “Look, this is something we’re going to work towards. And we’re not going to solve it tomorrow.” I think it’s easy to say we hit 50% women, we’re done, and we solved that problem, check, moving on. That’s not the way to look at it. This is a continually evolving process. There are always things that we can work on to help support every member of our community. **I think it’s important that she came in and said, “We’re going to do this.”** That gave us confidence, I guess, to tackle this (see video link on right).



Maria Klawe, Harvey Mudd College President, gave a talk on [“Increasing Diversity in the STEM Workforce”](#) you can watch on YouTube.

Donna: Liz, I think this is so important to what you point out because it’s a messy problem. It’s not a typical engineering problem, so to speak. It’s a messy problem and part of what you had to do as a college was make a commitment to doing it from the top down, but also knowing that there wasn’t one answer. The reason I want to emphasize this is that so often, schools will ask me **“What is the one thing that I can do to recruit women?”** I have to tell them it’s actually not one thing. As you say, it’s not an easy problem to solve so we’ve developed a system of doing it. Your college did a number of things that we’ll be talking about in this hour that we have together, and I think that part is key. I’ll tell you, last week I was in a call with six teams that are participating in our [WomenTech Educators Online Training](#). One of the things that I asked them was what their biggest takeaways were from the four recruitment modules. Each of the teams from each college that I was working with realized that they needed to do multiple things. And that it wasn’t impossible to do them, but they really hadn’t paid attention. In fact, I had a male chair of an engineering department say when we actually sat down and looked at our website and looked at our outreach materials and they were almost all male, you know, in 2015, we couldn’t believe it! We recognize that there are numerous things that we need to do and they are doable and that it’s not like we can put up one flyer and then the problem will be solved, so to speak. So it’s not really a problem. That won’t do it.

Liz: Right. One of the things that you said that made me think here is that it’s important to recognize that this is a community issue and not a male issue. There are lots of inadvertent things that are going on and lots of people perpetrating these things and you know it’s not a problem that the male faculty

here had to solve. This is a problem that we as a community need to think about. There are other issues of access that we could do better on as well, and I think it's a community problem.

Donna: Again, that is so important because one of the things that I emphasize is that it has to be both female and male faculty and administrators working together. I have had female faculty in my trainings and one of the things I talk about is what kind of messages we send. I will purposefully ask "How many of you have classes with no female students?" And invariably, I also have female faculty raise their hands. I point that out just simply by being female alone, that will not actually be enough for you to have female students and that you also have to use some of these strategies. I totally agree with you: it's both male and female, faculty and administrators, working together.

Okay, let me go on to ask you about something else that you mentioned that was part of Harvey Mudd's fabric, so to speak, which is working with the community. I know that research shows that overall as a group, female students care most about how engineering and computer science, all STEM (science, technology, engineering and math), helps others. Whereas male students, as a group, again, not everybody in either category, but as a group care most about the features of the technology. **So for female students in particular, they really want to see how engineering is used and preferably to help others. Could you talk about this and how you think this plays itself out at Harvey Mudd and in your engineering department?**

Liz: Sure, I think this might be one place where we're a little different than what's out there. Because I talked about the mission of our college and our mission of the impact of our work on society, we tend to get a lot of male students who care very much about what they're going to do with their project and who it impacts and how they are going to make a difference with it. So I'm not sure I see that as a huge differentiator here. I see female students who care much more about the technology than any other piece of it. But we tend to recruit people with that sort of "impact of their work" piece. So I see that a little bit differently here. That mission is so strong and it shapes everything that we do. I know that's a Harvey Mudd thing, but I think it could be a broader lesson learned for other departments and other places is focusing the whole department, or the whole program that you're working on, on the external impact piece. I think it can really help engage everybody, but I think it really engages the female students.

Donna: Could you give some examples of what that looks like at Harvey Mudd so our listeners can picture what these types of projects are that are out in the community using engineering? I think that would be really helpful.

Liz: Sure. For example, the first thing that pops into my mind is a project that we did in our [introductory engineering design course](#). In the second half of that course, we solicit projects from the community, from the campus community, from the broader community, various people that we know and it's not something that they pay for or anything like that. The idea is to give students the chance to work on projects for an external client. So they have not just the faculty member but also some other person from the community that they are trying to



meet their requirements. The one project that I am thinking of is from a family in the community and they had a little boy who was four years old at the time, who was a double amputee. He had some issue at birth and they had had to amputate both of his legs just above the knee. This is actually a really great project. They came in and they wanted a bicycle. This child is unable to ride a standard bicycle and the solutions that they have for children in this case, were difficult for a four-year-old to deal with. It's very, very expensive and they had a number of issues. It's not as safe as it could be. So the family came to our students and we had this initial meeting and they brought the little boy. He was wonderful. He was showing them his prosthetic legs and a whole bunch of requirements. His mom and dad both attended as well. The students were just so impacted by this child and their desire to help him and they came up with some really fantastic solutions. They had the little boy back, they had him riding the bike around the engineering department. They had him saying "Hey, I like this piece and I don't like that piece."

It was one of those moments, and I now have one of those students that was on that project in my research lab and he will reflect that that is one of the most impactful things that he has done in his time at Harvey Mudd because he felt like he was really able to take, even the basic skills that he had at that point when he was a young student, and really make a difference in this person's life. And that's why he came to Harvey Mudd. That was the "impact on your work in society" piece that he felt strongly about. So that's one example.

We have a lot of projects like that in our senior capstone clinic project. It's an explicitly stated goal that the students need to address the impact of their project on society. Let me tell you a little bit about clinic. The clinic is where we bring in industry sponsors. They bring in a project. It's the equivalent of a senior thesis but instead, they work in industry. We call it clinic after medical clinic. The idea is you practice medicine before becoming a doctor in the clinic and so we practice being an engineer before we grow up to be a practicing engineer in the clinic. So it's called "clinic". And in those, the students could just get into the technology and you know come up with a solution or whatever, but we ask them explicitly and specifically to state what they feel is going to be the impact of this project in the larger world. So they all do it. And they all think about it and they all think about it as they do their projects. That's what I'm talking about when I talk about the mission statement permeating through our curriculum. It's there sitting in the back of everyone's minds as they do what they do.

Donna: Wow. I have to tell you, I start to tear up. I felt so moved hearing about this four-year-old boy.

Liz: He's amazing.

Donna: Yeah. One of the things that often you hear is "Well, engineering is boring." And you know it's real. Students aren't interested in engineering. When I think about the story that you just told us about that boy, I don't think anybody could possibly say that when they are doing that type of project out in the community. There's nothing boring about that; it's quite the opposite.

Liz: Yeah.

Donna: Were you saying that that was actually a project that students are doing in their first year?

Liz: Yes, yes.

Donna: I think that's key. Because one of the things that I've seen, and you talk about the capstone requirement and that also is very important. I've often seen that there is an ultimate hands-on project that is in the last year of the program. And of course at that point, you've lost half the students.

Liz: Exactly.

Donna: Which the national statistics show is actually the case! Both female and male. And so, what's key is how you have brought that into the first year.

Liz: And I will say we have brought it into the first year and we've also brought it in different ways throughout the curriculum. There is a lot of literature on hands-on, active learning increasing student learning outcomes. That's really been something that the faculty at Harvey Mudd and across the country in engineering have embraced. And so you will see, even very small examples, somebody will in a circuits class work out a lot of circuit equations and then they will send their students down to build the circuit. Little things like that really reinforce the learning for the students.

Donna: Again, coming back to the literature, and I don't know if you're familiar, there is a book that is actually called [*Gender and Science and Engineering*](#) and it was written by two women engineers from Australia. I only came to know about the book, even though the book is almost like my bible, I love this book, it's a thin volume but full of best practice examples and one of the points that they make, and I was starting to say that I met them at the American Society for Engineering Education conference, and in Vancouver. **Many of the strategies that work really well for female students for engagement and also for retention also work really well for male students.** So while they're a female-friendly strategy because disproportionately they will work for female students, they also work for male students as well.

Liz: Thank you and overall retention of students in the program.

Donna: Yes, yes, yes. **So, I didn't ask you about this in advance, but how is the retention of your students in the engineering department?**

Liz: I don't have the numbers for that, but I do know it's very high. Our students don't declare majors until the middle of their sophomore year, so by the time they have declared they are pretty, they have had a chance to sample everything, and we typically don't get many switches after that. Students typically stay in the major they are in.

Donna: Excuse me. **Here is another clue of what works which is, of course, some schools require you to declare a major before you come in.**

Liz: Yes.

Donna: I think that actually works against having more female students.

Liz: I think so, too, because they might be intimidated. They might come in and say "Well, I don't know about engineering." Whereas when they come into a place where they can try it and they can say "Well,

you know what? I was kind of interested in that. That is interesting stuff. I think I can do that.” They would be more likely to pick it.

Donna: Exactly. It also fits in with what you’ve done with the introductory courses. Part of your changing what goes into those introductory courses was to attract more female students to declare engineering as a major. Or computer science, I know you’ve done it in that area, too.

Liz: We’ve done a lot in computer science as well. Yes.

Donna: So, if students have to select a major prior, there is not that opportunity. So for those schools that don’t have them declare a major until middle of sophomore year, there is an opportunity to use those introductory courses actually as feeder courses, and I’ve seen it done elsewhere as well. I think that’s very powerful.

Liz: Yeah, well I think you’re right. I think it all comes back to the confidence piece in the end.

Donna: Confidence and engagement because that project with that four-year-old boy, would that have been at one of the introductory courses?

Liz: Yes, it was. That was before major declaration.

Donna: I think that would be a game-changer for many female students, I really do, and also some male students as well. I think that is a really important piece. So let me ask you, you are of course a female engineer, head of the department and a great role model to your students. **Do you have other female faculty in your department? I know engineering tends to be a male-dominated faculty. So what does that look like in your department?**

Liz: Yes, and I think honestly, this is another huge piece. So we do have other female faculty. **There are 5 total women faculty here, 18 faculty currently.** 18-20 depending on how you count it; you know how these things are. So not super high percentage, but there are 5. I think there are a few things I’d like to say about this. We are all different. I think that’s really, really important. It is important for students to see that there is more than one way to be a successful female engineer. And you know when I was a student here, there were no female engineering faculty, there were a couple of female faculty in other departments, but the sort of messaging was that you can’t have a family, you can’t be married, you can’t have significant things going on outside of the job, there is a way you have to do this in order to be successful female professor.

I think because of the diversity in life situations that we have, they have a huge interest in talking to us about things. How do you balance your job with whatever it is that goes on outside of here? I think the other thing that is important is that there is a diversity of fields. We have electrical, mechanical, biomedical, and environmental — we have lots of different fields. It’s not just the traditional biology, biochemical kind of fields that our female faculty are in. They are across the spectrum of fields that we offer. I think that is really important.

I do want to just say that I think the male faculty in our department is committed to this gender diversification in the faculty. I really need to give credit to Clive Dym who was chair in the early 2000s here and made a concerted effort to recruit and retain female faculty here. A lot of mentoring programs when we were brought in, significant effort to try to make sure this was a comfortable place for us. It had a huge impact on the retention of female students in the program as well. I think the students sort of followed. I think honestly, if you were to say across the gambit the most active thing that we as a department did, it was in recruiting female faculty. The curricular stuff I would say came after that.

Donna: Probably, I don't know what the statistics are, you probably maybe have a better sense yourself, going to different conferences. I do know when I go to conferences like ASEE, it's primarily male faculty. Even though you are 5 out of 18 or 20, my guess is that's a pretty high percentage.

Liz: It is, actually. I don't have the data here, but I know it's on the high end. I'm not sure there are other engineering departments in the country with that high percentage. It's high.

Donna: The other thing I want to say is thank goodness the days in which you had to like give up your life in order to be in a male-dominated career pathway are behind us. And that you can have women who are different. You can have women who, if they want to pursue a family can pursue a family and also be on the faculty there. If they don't want to pursue a family, that's okay, too! There's a big enough tent for different types of female faculty.

Essentially the old model was you had to give everything up and you had to be better than the male faculty in order to be the one female faculty member in the department. Thank goodness, those days are gone and thank goodness, there are chairs like your former chair and many male chairs and deans and professors that I've worked with that are really committed to having more women. I think that's so important. You also don't want all of the effort to be only on the shoulders of the few women who are faculty. That shouldn't have to be their responsibility only to recruit more women or work on making the curriculum and environment more female-friendly. It's something that both the female and male faculty have a commitment to because you have a top-down support for this. It's a priority from your president. I think that those are important pieces that are worth mentioning.

Liz: Yes.

Donna: So, the other thing that I want to talk about is supporting female students. One of the things that I see both in the schools that we've worked with and the literature over and over again is the importance of supporting female students in engineering in order to help with ensuring that they will be successful and they will stay and have good retention. **And so I'm wondering, in addition to the curriculum changes that we've talked about, are there some specific things that Harvey Mudd does to support female students in engineering?**

Liz: Sure. Yeah, I think this is one of the places that we are very active right now. We're working towards doing better in this area. Let me tell you a little bit about what we have been doing. I do think that in addition to confidence, this community piece is really big. **So we have worked towards helping to support the community of women engineers here. I think this is really important for building and**

reinforcing that confidence piece that we already talked about. We have a vibrant community of students, an active society of women engineers chapter, it's large, they draw women in from the sciences as well as male students sometimes get involved. They are engaged in planning and execution of many, many community service projects. Some are quite large and impressive. They are noted across campus for their ability or organize. For example, they run this conference called Women Engineers in Sciences of Tomorrow (WEST). They bring in high school students from around the area, sometimes as far away as San Diego, and they come on a Saturday and organize all the faculty to give workshops and they have speakers and lunch and all this stuff. They often have 200 students here and they run that whole thing. We have one of our female faculty members is an advisor to that, we help them financially, we help them with space, we try to support that group as much as we can. Also, I've been spending some time with our junior and senior female students informally – little informal discussion groups to talk to them about how well we are doing in terms of this. Do they feel supported? Do they not feel supported? And help generate ideas for increasing community in the group or increasing what we can do. Some of it is that we don't, we can't fix something if we don't know what is happening, what their experience is. And from my perspective, especially, it's easy for me to look at this and say this is so much better than when I was here and not notice that there might be issues.

So from my point of view, what I have been trying to do is reach out, ask questions, listen, hear what they have to say, hear what their experience is of the program now and that's been really helpful to me to think about moving forward strategies for improving the experience for them. And you know it's not, there are lots of little things. I think in general, the experience for our female students is positive, but I think it's important to recognize that like I said before, I can't just say it is fixed, check and move on. I think it's a process.

Donna: That's so interesting, because I think many of our listeners would think okay, I've tackled that one. What I'm hearing you saying is there are other layers and it's an ongoing process. So part of what you're doing is gathering information from the female students in engineering themselves to see if there are improvements that you can make. I don't know if you're able to share anything with us, but I'm just curious if there are some things that emerged that you'll be looking at making changes in the future, or things that you're grappling with in terms of the messy problem.

Liz: Sure, yes, this is hard because it's important to acknowledge that, I hope no one is sitting there thinking "Oh, Harvey Mudd has all the answers." **We have some good numbers, we have had some successes, but we don't always get it right. Like I said before, it's a process.** During part of these discussions with these female students, one of the things they said to us is at the awards ceremony, all the awards seem to go to men. And we thought, really? Okay. That can't possibly be true. And we looked into it and it was sort of horrifying. It was, I'm not going to lie, not a great moment for the department. But they were right and wrong.

Basically for the awards that had a process in place where we had some criteria and some process for choosing where we and all of that, and we did it thoughtfully. We were reflective of the population when we gave awards. For the awards where the process was more ad hoc, where people sit around the corner and say this person and that person, we gave more awards to men. There is, as it turns out, and I

have learned since then, a ton of literature on this: inadvertent bias. Inadvertent bias happens when there is no process. Men do it and women do it and we were sort of horrified. It turns out lots of people know about this already; we just didn't. So we revised our procedures and are moving forward. I found it to be a somewhat humbling experience. It was a difficult thing to talk about in the department, especially early on in my tenure as chair. But I think it was important to have the discussion and I think when we framed the discussion, it was important for it not to be framed as "Well, the men have done this." Right? Because they didn't; we all had a hand in this. This is something that was happening under our noses and we didn't notice. So this is one of the things that came out of my discussions with the students. That's my airing of the dirty laundry portion.

Donna: Well, what really strikes me though is that you're willing to look at yourself as a college. That piece is really important and that you have created a total quality management feedback loop with your female students so you are willing to ask those hard questions and then you can get the information so that you can improve in this area of gender equity and diversity.

Liz: Again, I think a lot of us, especially the female faculty in the department, really felt like we should have noticed this. This was our responsibility. I think it's important to say "Look, let's give ourselves a break. This kind of thing happens. The important thing is that we recognized it, we looked for it, we asked, we saw it and we fixed it, or we tried to fix it or we are in the process of fixing it." And so I think that is the important part — to sort of acknowledge that you might not be perfect and you might not have everything exactly right and there might be things you can do to fix it.

Donna: Well, I think that actually, that is such an important teaching point for our listeners. **I'm wondering if you had to advise colleges that were at the 19% and were thinking "How do we get underway with this process? We'd really like to be like Harvey Mudd. We'd really like to have over half of our students receiving engineering degrees to be female." What would you recommend about how they get started and what you think is most important for them as they embark upon this process?**

Liz: Sure, I think let me just say the two pieces that you really need to build are confidence and community. Those are the pieces that really help. Let me just say when I was at Harvey Mudd, we were in the place where most places are. When I was a student in college, the percentage of women at the college was somewhere between 20 and 25%; in my class of engineers, it was 11%. And really what that was a different culture. What that felt like, as I reflect back on it, is that we were guests in somebody else's culture. We weren't contributors to it. We were sort of allowed to be there, that's how it felt.

In building the confidence and community, I think what you've got to get to is critical mass. Get to a place where you have enough women so it isn't unusual to be a female engineer. When you have that kind of culture where it is like you say "I'm an engineer" and they look at you like "Really?" That is a weird culture to be in. I think that is the goal. If you can build the community and bring in enough women through these confidence-building experiences that it's not unusual to be a female engineer, you've got your critical mass and that's a huge shift. For us, to be honest, I think the critical mass is somewhere in the low 30%. When you get somewhere in there, all of a sudden when you randomly

team in an introductory design class, you don't routinely end up with one poor woman stuck by herself, right? That's sort of where you think you have the difference happen.

I hope that's helpful. I think it's a journey. That's the one message I would like to send overall. We are not perfect, we don't have all the answers, cultural shifts happen slowly. But I think we are along the path, along the journey, and we are looking for ways to make this faster and better. I think really the important thing is the issue has been acknowledged. The fact that we would like more women is clearly stated. The fact that that is a good thing is clearly understood. I think those are battles that you have to get over at some point. If you don't have buy in that this is something you should be working on, that's an issue. You have to realize it's not going to get better on its own. You have to take some action. That's what Maria did for us, but I think people who are in positions like deans or department chairs or presidents of institutions like this, I think they have the power to say "You know what? We're going to do this. We're going to take action."

Donna: I think those are such important words of wisdom. And I often tell people I think that our job will be done when there's nothing exceptional about being a woman engineer, or being a woman in STEM.

Liz: Exactly.

Donna: Just a normal part of the culture. What I'm really looking forward to in the future is that it will just be matter of fact. I have so enjoyed having this conversation with you and learning so much more about how Harvey Mudd has achieved the success that they have to date, and I know that there's still some pieces that you're working on. I think this is going to be so helpful to our listeners who are, as you say, embarking on that journey. Thank you so much for taking the time to be part of our STEM Success for Women Telesummit.

Liz: Well, thank you very much for giving me the opportunity to talk about these things. These things are hard things but I think they are important things to talk about.