

➤ ***Dr. Streveler: Welcome to the Research Briefs Podcast.***

I'm your host, Ruth Streveler, coming to you from the School of Engineering Education at Purdue University.

The goal of Research Briefs is to expand the boundaries of engineering education research. In these podcasts we'll speak to researchers about new theories, new methods, and new findings in engineering education research.

My guest today is Dr. Elliot P. Douglas, professor in the departments of Environmental Engineering Sciences and Engineering Education at the University of Florida. He was chair of the Educational and Research Methods Division, also called ERM, of the American Society of Engineering Education. Elliot also served as a program officer for Engineering Education at the National Science Foundation (NSF) and as a deputy editor of the Journal of Engineering Education.

So, as you can see, Elliot's done a lot of important stuff with engineering education. I've known him for 15 years, we calculated the other day, kind of **aghast** at that. And he is one of the most highly regarded qualitative researchers in engineering education. Understanding qualitative research is one of the most difficult areas for a new engineering education researcher and so we wanted him to talk about this today. Through his own research and his time at NSF and at the Journal of Engineering Education he's seen a lot of qualitative proposals

and articles, and I know he has some very interesting thoughts about that to share with us today. So, welcome Elliot.

❖ **Dr. Douglas:** Thank you, Ruth, for inviting me and I'm looking forward to our conversation today.

➤ *And, congratulations on Engineering Education being a department at the University of Florida. I know that's a new development.*

❖ **Yeah,** that really just happened within the last couple of weeks. And so, we're looking forward to really getting that going, establishing our Ph.D. program, and enjoying the ranks of other departments.

➤ *That is wonderful.*

So, one of the things I didn't mention in your introduction is your educational background which was in Material Science. And so, your early research obviously was in Material Science and now you're a qualitative researcher which doesn't seem like a very direct path. Could you tell us a bit about that path?

❖ **Yeah.** So, well you know it fairly well because my first real introduction to engineering education research was the Rigorous Research and Engineering Education workshop that you and Karl Smith put together. I was lucky enough to be able to attend the first one in I think it was 2004?

➤ *2004, yeah.*

- ❖ **Yeah. And so, you know, that's where I first heard about all the different pieces of engineering education research and how to do it. And I think the biggest thing from that workshop was that we received a mini grant of some very small amount to do a project that sort of required a guess. And, you know, as you might expect I did a quantitative study; I decided to look at critical thinking and I used an existing instrument and I ran a cohort of graduate students and a cohort of undergraduate students through that instrument. And I got some very strange results in that the undergrad students scored higher than the graduate students.**

And then when I looked at the data a little differently, I saw that the graduate students had actually not completed it within the time allotment; and I had noticed this anecdotally when I was giving it whereas the undergrads had. And so, I remember emailing you, Ruth, and you suggested, "Well, you could do something sort of qualitative and ask them what happened." And so, I did that, and I got some very interesting results. Essentially the undergrads saying, "Oh, it's like the SATs, I did that recently. And some of the questions were confusing so I took my best guess and moved on." And the graduate students saying, "Well, it's been a long time since I've seen a standardized test like this, like the SATs, and some of the questions were confusing so it took me a long time to figure it out."

And I think that really pointed out to me the power of qualitative research to understand the *why* behind things. You can get quantitative numbers of

something, you can have things with the same average maybe even in different distributions, or different averages, you know, on t-test they come out differently. But it doesn't tell you why that's happening. And that's really what qualitative research does.

And those are the kinds of questions and things I started to get interested in and so that's why I really moved to qualitative research.

➤ *We find that with so many of our graduate students that they'll come in only knowing quantitative and therefore thinking that's what their research will be. And then when they get a taste of qualitative and see the richness, they kind of get hooked.*

❖ Yeah, because I think you can really get into depth and understand people, understand what's going on with qualitative research. I find it fun. There's a lot of philosophy involved, and you're really understanding people when you're doing qualitative research.

➤ *Now speaking of philosophy, I understand that when I did a little research on you, that you have like a double undergrad degree in was it materials and music?*

❖ Yeah, it was in music. Yeah, although, to be honest, it's more like a minor because they didn't have minors at the time. So, I was able to double count like half of my materials courses. I've always music of various kinds; actually, I find lot of engineers do it and actually because music is actually

very quantitative I think. A lot of engineers do music.

➤ *So, I put that out because we have this stereotype of, "Oh, if someone did engineering research, therefore they couldn't be interested in some other kind of more human thing." And seeing that you were also studying music reminded me that that's really a very false idea of engineers as well.*

❖ Yes, it is. And I think we do a disservice in the way we educate our students sometimes in terms of teaching them that engineering is about like solving these mathematical problems, when it's really about the social dimensions of creating solutions for society and helping people. And I think a lot of students get into engineering with that mindset that that's why they want to do engineering of various kinds. And then maybe they get disillusioned by it and they become socialized to a different way of thinking that's not in line with what they wanted and then either they drop out of engineering or they keep going but then they get into the workplace and it's different again.

➤ *So, I'm going to actually ask you one question that I didn't prepare you for, and I realize that I know, obviously, having helped to lead the RREE in 2004 I know about that part of your story, but I actually do not know what attracted you to apply for the RREE in the first place.*

❖ Oh, I'll have to think back a little bit. I mean I can take you through the story a little bit more going back to when I joined the University of Florida in

1996. I didn't really have any teaching experience, but I had always been interested in things. I had tutored a friend through qualifying exams and she always said that she would not have gotten through the Ph.D. qualifying exams if it wasn't for me. So, I was always interested in that. I had been working at Los Alamos National Laboratory and I'd looked into the possibility of teaching at the University of New Mexico branch campus up there, but not very seriously. I just quickly decided it wasn't going to work with the travel schedule I had and things like that.

So, I came here with an interest in teaching and the first summer, so it would've been the summer of '97, and I taught one semester. Then I went to this workshop at West Point, at the time called, "Teaching Teachers to Teach Engineering," now it's "ExCEED: Excellence in Civil Engineering Education," 'cause it's run by the American Society of Civil Engineers. But I learned the techniques for teaching that they have there. Because most of their faculty are just on a usual 3-year military assignment so they can't afford them to take a year or two to figure out how to teach. So, that department, in particular civil and mechanical engineering, puts them through this training process; they've gotten a grant to teach others. And it was very successful for me, like my evaluations went up.

And I'm not sure I can place how, or why, or when it happened but I became interested in the Scholarship of Teaching and the Learning aspect of it; am I effective in a classroom? I started trying some active learning things. And I collaborated with someone here briefly, who was here for a little while, we didn't get a whole lot done but I was looking for more opportunities like

that and I got an email or something about it and it just seemed to be what I wanted to do and I guess I took to it pretty well.

➤ *Yes, yes, we would always call you the “RREE Poster Boy.”*

❖ Well there’s plenty of others out there.

➤ *There are but you were from that first cohort and you were the shining star of that first cohort.*

So, kind of going a little bit forward in time now, learning about qualitative research is difficult for a lot of people because it does require a paradigm shift. So, I’m going to take you back to now you have this mini grant from the RREE, it’s 2004-2005, can you say a bit more about that part of the process now knowing that you’re really known for this kind of research? Can you say some of the beginning steps that you took and how you did that?

❖ Yeah, so I look back now and I think at the time I thought I was doing qualitative research when I sent that email out and now I kind of shudder to think of calling it ‘qualitative research’, but it was a starting point. And I just started trying to find resources, I really didn’t know anything. I got lucky and I talked to Alisha Waller, who was a qualitative researcher, and she was very kind to spend quite a bit of time on the phone with me talking through things. But then I wanted someone local that I could potentially learn from, and I looked in our College of Education and I found the name of a

qualitative methodologist, Mirka Koro-Jlungberg, and I was going to AERA, American Educational Research Association, and she was giving a paper and I essentially walked up to her at the end of her talk and introduced myself. When I've talked to her since she said like, "Who's this *engineer* that wanted to talk to me on qualitative research, that doesn't make any sense, right?" But she agreed and one of the things she told me was that she ran this, I guess I could call it "support group" for qualitative researchers on campus, mostly students, who would present issues they were going through sometimes it was things like, "How do I convince my dissertation that this qualitative stuff I'm doing is worthwhile?" So, I started going to that and just learning a lot from that.

And then I have my Ph.D. and the dissertation that I did for that, but I always say that I have another dissertation in engineering education and qualitative research; and that is the 2008 paper that Mirka and I did together on a meta-analysis of qualitative articles in the "Journal of Engineering Education." We compared the stated epistemology in those papers with the sort of assumed, based on the way they did they're research. We looked for matches or mismatches or no statements at all. And I call that one my dissertation because that was four or five years after I started with doing work and what happened through this support group was one semester, we as a group, decided we wanted to learn about writing papers, qualitative papers. And so, the process was that we were all going to write papers and talk through each section every time we met, once a month or so. And to do that, Mirka and I worked together to create this paper through that process. And so, I learned all about epistemology and

theoretical frameworks through the process of analyzing the papers we looked at and then writing that paper. So, it was a long process, four or five years before I felt comfortable with this idea of epistemology and that focus continues to grow; it never ends.

➤ *Right, right. So, I know you said you did lots and lots of reading, and still continue to do lots of reading. A couple of things that are common stumbling blocks when people learn qualitative research is, they find the language sometimes difficult. Did you find that as well and if so, how did you help yourself deal with that?*

❖ **Yeah, the language is difficult and can be confusing at times, the same term is used to mean different things. So, again it's a matter of reading. One of the things about, maybe this isn't just about terminology, but it's about methodologies in general is never stop reading about them. So, unfortunately, I see too many examples of people who cite a book, kind of a general methods book, so maybe Creswell's book as an example, and that's the end of what they've done. You can't do that because that's just one perspective, that's just one piece of it, and there is so much more that you can read about. There are books on all the different methodologies, there are books and articles on interviewing. I just subscribed to table of contents alerts. I just got one this week about transcription. You think like, "Transcription? That just, you know, send it out to somebody or listen to it and write it down." But this article was talking about the epistemological choices that are made in terms of how you do a transcription and what analyses are and are not possible depending on how you do that**

transcription. And so, even something as simple as that isn't actually so simple. Not an article I would've found or necessarily thought about if I hadn't subscribed to this table of contents alert.

The other thing is, early on, so I would go to Norman Denzin's Qualitative Congress which he has every May at the University of Illinois where he is, and this is populated with qualitative methodologists, so people who think about methodology all the time and are writing things about methodology and stuff. And I'd go to these talks with these big names and I would understand very little of what they were saying. But that was okay because I started to pick up things as I went along. In fact, I remember one time Mirka, who I mentioned, she gave a talk at the Congress or something and then followed up with a talk at AERA, or vice versa, and it was the same talk. And I mentioned I was going to go to a second one and she said, "Well, you already heard it at the other conference." I'm like, "Mirka, I only understood like 10% of the talk you gave the last time, maybe if I go again maybe now I'll understand like 10% more." Right? And so, don't be afraid to not understand. Understanding is continuous.

➤ *And you have to just kind of again, find those people that are willing to help translate.*

❖ Yeah, exactly. Yeah, finding a mentor, things like that.

➤ *Now you mentioned the word, "methodology," so this might be a good place to have you help listeners over what sometimes can be confusion*

between the words 'methodology' and 'methods'. Could you explain that?

- ❖ Yeah, so, methodology, I'll give sort of a definition and then I'll give an analogy. Methodology is the overall approach you're going to take to the research. So, common ones people have heard of: Thematic Analysis, Grounded Theory, Narrative Analysis, Phenomenology, Phenomenography, Discourse Analysis, things like that.

Methods are the specific steps you're going to take: Interviews, I'm going to Code data, I'm going to do this particular thing.

And so, the analogy I give is to like planning a trip. So, the methodology is the overall plan for the trip: I'm in Florida, I'm going to go visit you, Ruth, up at Purdue. So, I'm going to decide am I going to drive or am I going to fly? And I want to go in the summer when it's hot here and not too cold there. So those kinds of things kind of set out the overall plan. So, I decide I'm going to fly. So, now I'm going to look for flights.

So, now the method is, I'm going to fly from Jacksonville, Florida because it's cheaper for me to fly from there, and it's less than an hour-and-a-half drive. So, I have to get in my car, I go to the end of my street, I turn left, I turn right at the next light. I follow that road, etc., etc. I'm going to go to this parking lot, I'm going to fly on flight #1234, which leaves at this time. Those are all the methods; and so those are the specific steps. And one of the things that this analogy helps with I think is this idea that 'methods' and 'methodology'

need to be aligned.

So, if I decide that my methodology for my trip is an airplane flight, then it doesn't make any sense for my method to pull up Google Maps and see what the route is for me to drive all the way from Florida to Indiana because that's a method but it doesn't match the methodology of flying in airplane.

Same thing, so if I'm going to do grounded theory then that tells me how I'm going to do my interview and what my interview questions are going to be like, which is going to be different than if I'm doing a phenomenography and doing an interview for a phenomenography; or a narrative analysis, I'm doing an interview for a narrative analysis.

So, think about that as you're thinking about it. You can't just do an interview and then decide, "Oh, I'm going to analyze it this way." 'Cause you want the right data. Because your method didn't match your methodology.

➤ *So, have you as you were both looking at papers as a deputy editor for the "Journal of Engineering Education," or looking at proposals at the National Science Foundation (NSF), did you find that methodologies and methods didn't match often? Is that a common mistake people make?*

- ❖ Well it is a mistake; I'm not sure I would say it was common. I don't have any numbers to say it was common or not common. But it is a mistake. People not aligning methods and methodologies and research questions and epistemologies. And also, particularly with papers, you can tell that

someone hasn't thought about why they're doing what they're doing. So, they're treating whatever they read as a checklist. Like, "If I do this, this, this and this, I've done qualitative research." Throwing around terms that don't really make sense; for example, calling the constant comparative approach a methodology. That's not a methodology, that's one of the methods of the things you did to look at your data; but it's not a methodology. Or, saying something like, "We did phenomenological interviews," and that's the only time phenomenology is mentioned; things like that.

So, again, that comes down to understanding why you're doing what you're doing. Making decisions about that, conscious decisions about, "This is what I want to know and therefore this is what I need to do." Not just like, "Oh, I'm going to do grounded theory, and this is what Kathy Charmaz says I'm supposed to do; this, this, this, this and this," and then I've done grounded theory. That's not a good approach.

A better approach is, "What do I want to know, that matches up with grounded theory in some way, and then I am going to really try to understand and look at what I'm doing." A really, really good guidance for this, to help you think about all these pieces, is what's called the Q3 Framework. Jo Walther, Nikki Shochacka, and others published this in the "Journal of Engineering Education," and it's a set of guiding questions around validity for qualitative research. And I think it really even goes beyond this idea of quality; I mean they designed it to help you design your research study, but I think it helps with the methodology. 'Cause it's

questions like, “Does this research help me to understand the reality under investigation?” That’s something you need to make sure you’re actually doing.

➤ *And so, when people become overwhelmed by the possibilities of the methodologies that are available, I think I’ve heard you say before that, having this idea of what is it that you really want to find out is a good guide to help you through that sea of possibilities.*

Yeah, that’s how I always start. And I have two NSF funded projects right now, and I can kind of explain those two and how what we wanted to know defined the methodology. And from there the proposals sort of wrote themselves, if you will, at least the methodology section.

So, one is on understanding ambiguity in problem solving. And where we started was, we’d done some work on problem solving in the past me and my colleague David Therriault, here at the University of Florida, who’s in the College of Education. And he’s a cognitive scientist, quantitative kind of guy. He was on the original projects with Mirka Koro-Jlungberg, that was our original team, she has since left here, she’s at Arizona State now. So, we knew that what we eventually want to do is we want to understand how student’s ability to understand ambiguous problems, different kinds of ambiguous problems, is correlated with other characteristics. So, for example, their content knowledge, or their working memory capacity, or their epistemic beliefs. And that’s the proposal we were going to write.

We started thinking about how would we write ambiguous problems of different types? And looking in the literature it turns out there is no definition of ambiguity, especially related to engineering and problem solving. People define what ill-structured problems are, there's David Johansson's Taxonomy of Problem Types, but people mention that problems are ambiguous without ever defining what it was. So, we had no guidance to go on. And then David said to me, "You know, what we really need is like a taxonomy of ambiguity." And as soon as he said, "taxonomy," I said, "Oh, that's a phenomenography." And that has guided everything we did and are doing. So, our interview protocol is around trying to understand the variations in ambiguity. So, we ask questions about like, "Okay, why is this problem ambiguous? What could make it more ambiguous? What could make it less ambiguous?" You know, those aren't the kinds of questions we would ask if we were doing some other kind of methodology. So, that's one.

The other one we're doing is we're looking at experiences of black engineers in the IT industry. In that particular case, for various reasons we wanted to make sure that we maintained the voices of individuals. Really where it started was our industry partner who is really trying to push within the industry in the Silicon Valley area in California, increased diversity, there's been a lot of talk, but the climate at companies, they can hire a bunch but the climate at companies is not great. And so, he wants to be able to bring stories of people to directors of companies and executive boards because stories are more powerful than just numbers when you talk about this. His idea was if you could hear the people speaking about the difficulties they're going through that might prompt some changes in climates at these companies. Well if you're talking

about stories, you're talking about narrative analysis. And so, from the very beginning, when he and I first started talking two-and-a-half, three years ago, we've been developing this idea around doing narratives. And then the other reason for doing that is because these experiences are so personal, breaking them up in the way that like grounded theory would do doesn't make sense. We want to be able to tell each person's story; each person's story is unique. And so, again, I immediately said, "We'll do a narrative analysis."

So again, I just come back to this idea that, what do you want to get out of the study? What do you want to know? And what kind of an outcome do you want? A taxonomy of problems of ambiguity, we wanted stories of people's experiences.

➤ *So, another question I would like to ask is, in the podcast I encourage people to think about creating new methods. And I know you have a viewpoint about that question that I would very much like you to share. So, please do that.*

❖ Yeah, I don't think that question in and of itself makes any sense, at least to me. Because it implies some formalized process, I think, of how do I create a new method, and then some formalized structure at the end which I think may turn out to look too much like a checklist.

So, I suppose that in my research group we have created methodologies, but it's really just because we're trying to figure out what to do to get the data we want, or get the analysis we want. For one example, in the ambiguity

project, we're using what we're calling artifact elicitation. Sort of in parallel to photo elicitation where we ask someone, in this case, to bring in two or three problems that they think were ambiguous they've had to solve at some point. And where this came out of was actually a different question that critical thinking where my student was having difficulty getting the participants to talk about critical thinking. Like it was just like, "What is critical thinking to you?" And they were like, "Uhh," you know, some big vague thing. And so, what we came up with was this idea of, okay we want to know when they tried to use critical thinking, so let's ask them to bring in something that they thought they needed to use critical thinking to do. Then we can just ask them why? What is critical thinking? What did you have to do when you solved this to use critical thinking?

So, publishing a paper with Shawn Jordan and Micah Lande, and the ASEE Conference proceedings in I think 2015 called "Artifact Elicitation," but was just a pragmatic thing like how can we get the data we want?

Another example, so I'm working with a student from electrical engineering who is looking at the experience of undergraduate teaching assistants through this program that he created. And he's really interested in motivation and things like that.

So, he's pulled a bunch of theories together, that he's kind of mushing together, I guess that's another creation thing, right? How do I create new theories? I don't, like he pulled a self-determination theory and commitment theory and adult learning theory, I think it was, and he's

identified some parallels so he's going to do that analysis. So, we talked about how would you analyze the data from these different perspectives? And, you know, what we came up was this idea that you read the transcript once through the lens of self-determination theory. And this builds from a book called "Thinking with Theory" by Alecia Youngblood and Liza Mazzei, we can talk about coding in just a minute, but it's this idea that you don't code data. You read the data through the lens of a theory. So, what we came up was, we'll start with self-determination theory and look for statements that are related to the elements of self-determination theory and highlight those in different colors depending on whether it's competence, autonomy, or relatedness; the three pieces of self-determination theory. And then we'll do that, and then we'll do that for commitment theory and whatever. And so we'll be able to pull out these different pieces and say, okay how do these different people talk about their experiences and why they did what they did as an undergraduate TA, or why they became an undergraduate TA through the lens of self-determination theory, or the lens of commitment theory.

So, is that a new methodology? I don't know, it's just something that he's doing to answer the questions that he wanted to have answered.

➤ *So, what I really enjoy about your perspective is that it highlights that this is a very organic process, that again this isn't creating something then that is written in stone somewhere, but that it is driven by your purpose. And that, of course, you want to document what you did so that people could understand it and decide if they agree with it or not.*

But I just really enjoy that.

So, since you mentioned coding, we have to have you talk about that a bit because I know that what you have to say will be really enlightening for people.

- ❖ Well the first thing is a lot of people think that coding is qualitative research, that is if I'm coding I'm doing I'm doing qualitative research and if I want to do qualitative research I need to code. And if I say that I coded that's sort of sufficient, right? And it's not.

One thing I saw a lot in proposals was they just are like, "Oh, we're going to do standard qualitative analysis and we're going to code the data." Like that was the entire method section. The reader was like, "No, we need to know what you're actually going to do. How are you going to code? What kinds of things are you going to look for when you're doing one?" There are all kinds of things to do with coding and I also like to always give examples when I write proposals or write papers. So, it's not just that I coded, but I'll give an example of like for a paper it would be like, "One of the persons said this kind of thing and this was coded and this, and then that was combined with other codes to make this higher level code, etc., etc." And then maybe give a table of all the different codes or something, but more than just, "I coded."

But more fundamentally, I'm actually moving away from thinking of coding as an appropriate technique for qualitative data analysis, particularly in the

interpretative approach. And I'll say this comes out of work published by Elizabeth St. Pierre who's at the University of Georgia, and she calls it "Post Qualitative Analysis or After Coding." Patti Lather has also written some about this, she's at Ohio State. So, the issue with coding that they talk about is that it is positivist in a sense; you're breaking down data into little manageable chunks and then rearranging them in somewhat that gets something new. Then the other problem with it is you sort of lose the individual, the personal, the deepness when you break things apart like that. And then the other problem is that most of the qualitative research scene where they do something like that, and they say they did grounded theory, this is another common one, they say they did grounded theory when they really only did thematic analysis, I shouldn't say, "only," because thematic analysis is useful but they didn't do grounded [unintelligible] theory, they did thematic analysis. But the themes they come up with as Betty St. Pierre has said something like, they're obvious, they're every day, they're just descriptive. It's like I could've come up with that list just if I sat down and thought a little bit about like the environment. To me that is not useful at all. I don't need a description I need more *interpretation*. What does it *mean*?

And so, in my mind coding doesn't help you do that very well. I mean you can sort of try to do it, but it doesn't do it very well I've learned. And so, these other ways of reading through theory and trying to understand the nuances and the interpretation, and what's behind what they're saying; rather than just taking things that they saw. You know, there's this attitude a lot of times of, "Well we need to let the voices of our participants speak

for themselves,” or something like that. No. If I wanted to do that, I could just have a conversation with somebody. No, what I want is I want to understand why that’s happening, why they’re saying what they’re saying, what’s the connection to the way we understand the world? That’s what I want to know.

➤ *So, I ask as an ending question to people to give advice. So, I will ask that to you as well. If someone is just starting out doing qualitative research, or even thinking about it, what would be advice you would have for them?*

❖ **Read. Read a LOT. And just work your way through stuff; there’s lots of different levels. I’ll do a little personal plug that Caroline Baillie and I wrote a guest editorial for “The Journal of Engineering Education” in 2014, Issue No. 1, and it goes through a lot of these things we’ve talked about today. So, it talks about method versus methodology, theory versus theoretical framework ‘cause those terms are used differently in the qualitative world and in the engineering education research world. And then, as examples of epistemology, we used design education as an example and pulled a bunch of articles that were all about designed education, qualitative but done with different methodologies and different epistemological perspectives and talk about that and show how, to get a complete picture, you know, each one gives you a different view of it. And then certainly the whole thing. Even quantitative work is important to that. Because it is, right? We need to know some of those general trends, you need to understand the big picture**

which is what the quantitative theory can get you.

- *Well to help readers we will have that citation and the website so they can look it up and I think it's about seven pages long; so, it's not huge, but it's not a few sentences either, so it's a good starting point I think.*

Well I could keep talk to you for a long time.

❖ **It's fun to talk about this stuff.**

- *It is fun to talk about it and maybe we'll have to do part two at some point. But, for now, I know you've got stuff to run off and do, so I will just say thank you very much, it's been really enjoyable and fun chatting with you.*

❖ **Well thank you for having me. I've had fun too.**

Research Briefs is produced by the School of Engineering Education at Purdue.

- *Thank you to Patrick Vogt for composing our theme music. The transcript of this podcast can be found by Googling "Purdue Engineering Education Podcast." And please check out my blog, RuthStreveler.Wordpress.com.*