➢ *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.

Our guest today is Dr. Michael Loui. Michael holds the Dale and Suzi Gallagher professorship in engineering education at Purdue University. He previously was a professor of electrical and computer engineering at the University of Illinois at Urbana-Champaign for 33 years. He served one year as a program officer at the National Science Foundation (NSF), four years as an associate dean of the Graduate College at Illinois, and five years as the editor of the "Journal of Engineering Education."

Welcome, Michael, you've had a long and varied career, and I know you've accumulated wisdom from those experiences, I thank you for sharing those ideas with our listeners. And we hope you'll provide advice from those various perspectives.

Can you begin by giving the listeners a brief account of your journey, first into the scholarship of teaching and learning and then into engineering education research?

- ❖ **Dr. Loui: Yes. Thank you, Ruth, for inviting me. When I began teaching electrical and computer engineering at Illinois in 1981, I had had no preparation or training for teaching. But I'm an academic so I have an unusual habit of learning from books. I read books on college teaching such as the seventh edition of "Teaching Tips" by Wilbert McKeachie, which is now in its 14 edition, I guess. From these books I became aware that there was research in college teaching; I continued to read books and newsletters for classroom teachers. Then in the early 2000s a couple of masters students in electrical and computer engineering asked me to supervise their thesis projects related to classroom teaching; we would call these "scholarship of teaching and learning" kinds of projects because they were aimed at understanding what happens in a classroom and improving our teaching practice. We presented the results of these thesis research projects at conferences.**

  Then in 2003 I was named a Carnegie Scholar by the Carnegie Foundation for the Advancement of Teaching to contribute to that movement for the scholarship of teaching and learning. I like to call the scholarship of teaching and learning or SOTL the gateway drug to more rigorous, discipline-based education research. During this period after the Carnegie Scholar's year I collaborated with graduate students and faculty, colleagues and research projects in engineering education often with the generous support of grants from the National Science Foundation. So, I was doing that for a few years and then I became noticed and although I had spent some time on the editorial boards of more technical journals, I was invited to become the executive editor of a journal called "College Teaching" in 2006. And so, I had

had experience as a journal editor before I was invited to apply for the editorship of the "Journal of Engineering Education." So, like "College Teaching" is a scholarship of teaching and learning journal for classroom teachers, but "Journal of Engineering Education" addresses a somewhat different audience. Nevertheless, I thought I might be qualified. A member of the search committee invited me to apply and independently the dean of engineering at Illinois also encouraged me to apply in the fall of 2011.

Indeed, I did apply; I was interviewed and then I was offered the position. I went back to the dean to remind him that he would need to commit substantial funds for a half-time assistant editor, and he agreed. Then I walked to the office of my department head to request a reduction in my teaching assignment. By the way, I never say "teaching load," which implies that teaching's a burden because teaching's an opportunity. The reduction in teaching assignment would be I thought necessary because my predecessor, Jack Lohmann, as the editor told me that the editorship was a quarter-time position; although he did not tell me the numerator for quarter-time; a quarter of his very long workweek. In any case, my department head agreed to the teaching reduction.

So, since the dean was willing to put up the money and the department head was willing to reduce my teaching assignment, I was left without an excuse to decline the position and I accepted the editorship. It was a great honor and a great amount of work, but an important stewardship responsibility of senoir people like me to help the field advance.

> *So, is there anything you would want to say about your vision for JEE when you took it over from Jack? I know Jack Lohmann; those were big shoes to fill.*

❖ I didn't have a really big vision; I had a small vision. I wanted JEE to have at least something in every issue that would appeal to readers across all parts of engineering education, not just researchers but also classroom instructors and administrators. And, at least, I think the guest editorials served the purpose. And occasionally I would use my bully pulpit and write an editorial myself. As you know, most of the articles do address other researchers, and so it wasn't hard to achieve the full part of my vision, but I was glad to be able to find quite accessible guest editorials for each issue that I was responsible for.

I also spent five years institutionalizing the changes that Jack had made; it was really a period of consolidation. If you like I could say a little bit more about what I did.

> *Sure.*

❖ So, Jack had initiated the emphasis on theoretically grounded methodologically rigorous research around 2005 or so. So, during my first year, my assistant editor and I were managing the transition to Wiley as our new publisher. We had a surge of manuscript submissions from 150 per year to 300 year, so I needed to recruit and appoint more associate editors. The editorial board and I then revised the author guidelines and some of our

internal processes to help with the emphasis on rigorous research and also to handle the large number of submissions each year. We also began returning the deidentified decision letters which included all of the peer review reports back to all of the reviewers as one way to educate reviewers about our standards and expectations so that each reviewer could read the reports of the other reviewers and gain some learning that way. Although this is a standard practice in many journals, it had to be initiated at JEE as well. And I'm glad to see that the practice is continuing.

I'm also proud to report that during my tenure qualitative research methods really became accepted. Every issue had at least one qualitative or mixed-methods study. So, I think we were in a period of consolidation and I'm glad to see that with the editorship of Lisa Benson, for the last couple of years, it's continued to grow and thrive.

➢ *Yes, yes. Now I have a question to ask you, and I know I didn't think of this before, so you haven't had time to prepare. When you were speaking about having JEE be available or having something there that's accessible to the more general reader, it made me think of the JEE Selects item that's in the "PRISM" magazine for ASEE. How are those articles selected?*

❖ Yes, so JEE had an agreement with the ASEE "PRISM" magazine which goes to all members of the American Society for Engineering Education, and that is published eight times a year. So, in the past, Jack would just choose an article and invite the authors to write a 650 word version of it that would be

more accessible to a broader audience and he'd work with the authors to produce that short version as a way of publicizing the work and showing its potential application to classroom practice or administrative practice. I continued that tradition by choosing articles and working with authors, but I also opened it up to our sibling journal, I would say "sister journal" but nowadays with gender fluidity and all . . .

> *Yes, yes. Sibling is better.*

❖ **. . . advances in engineering education, so they had four issues of PRISM per year to have that column and we had four. So, I tried to choose articles from JEE that might be of more general interest and I worked with the authors. I'm very proud of the magazine versions of those articles that we produced. I do encourage people to look at those and then each article ends with a reference to the article in JEE where the original appears, and many of them really are quite readable, so people can find those.**

> *Yes, they are. Right, right. Well I was going to ask you to kind of do advice for people in putting different hats on and since we've spoken a bit about your editor hat, are there things that you want to say that are directly related to that such as advice for writers or writing a publication, selecting a journal?*

❖ **Yes, I have a lot of advice that I've shared with graduate students on all aspects from starting a research project to writing the manuscript to choosing the journal. So, maybe we can start with the first part which is**

about selecting a research problem and preparing for that.

I think just being prepared is always a good thing as well. I like to echo what a number of your previous guests have said, is that it's important to read widely and get good ideas from other literatures, especially methods. In my own case, my own journey from SoTL through engineering education research I've stolen good ideas from physics education, chemistry education, and computing education; I've done work in concept inventories, peer-led team learning, peer programming. So, that's the first bit of advice; be open to other literatures and getting good ideas from there.

Then as people get started in doing research, I think one way of learning how to use various new research methods is to do a replication study of a study that's used in the kind of method that you'd like to try to use. We need more replication studies to assure ourselves that our findings really do extend across the particular context in which they were done. If you're doing quantitative studies we talk about generalizability, if you're doing qualitative studies we're talking about transferability to other contexts. So, that will give the field more confidence that the findings really do extend to other situations. So, replication studies allow you to follow somebody else's research design and it's easier to do that; although you should always look for potential improvements.

Then I also heard that Nobel Laureate, Herbert Simon, said that to do good research you should choose a good problem and possess a secret weapon. So, the secret weapon would be that special tool or method that you'd

become schooled at using, and it's important to be comfortable using those methods, and proficient.

But then the research question is also important. And I advise people to choose a research question about an important problem where you can make an impact. Your personal curiosity is necessary but it's not really sufficient. I feel life is too short and research is too expensive in terms of time and energy to devote to projects that don't make an impact. So, always think about what the potential impact of your work could be. Be prepared to say the significance, to answer the big "So what?" Don't just fill gaps in the literature, some gaps are simply not worth filling. I once I thought I should write a peer review report that says, "This paper fills a much-needed gap in the literature." So, we're looking at maximizing impact so one way to do that is to connect your research problem with something that other people care about. So, in engineering we care about retention of students, we care about broadening participation, and so on. So, start with your small project; it has to be just a piece of our larger edifice of knowledge, but a project that still addresses a piece of the big question and helps people see the connection in how your work might impact that.

➢ *I agree.*

❖ You agree. Good. So, often you'll start with a smaller pilot study, getting preliminary data can help you get going and get feedback from that. You can also parlay the pilot data into grant proposals and maybe I can put on my program director's hat since I was spent four years at the National

Science Foundation. When I was at the National Science Foundation, the average NSF grant represented the federal tax returns of about 11 households. So, imagine going to 11 families in your neighborhood and ask them whether they're willing to allocate their tax returns towards your project. Now, if you are at a college or university you may live in a community that values higher education so that might be an easier task than somebody who lives in a large urban community. But still, I think that's an important vision to keep in mind; would your work have some meaning to people who are going to fund your work?

➢ *I wonder now if it's maybe up to 15 households or something we could see as the grants have gotten bigger?*

❖ Well, yeah, it depends on the grant size. So, I'm just talking about a rough number there. When I was at the National Science Foundation, I liked to explain the value of what we were supporting to everyday just ordinary lay people like cab drivers. And I think I found that many people have a favorable disposition toward research, they realize that research develops new technologies, or in our case, better ways of education that make all of our lives better. But they just want to know what they're getting for their money. And I think that the idea of communicating with the public is really important too, so that's another reason why I want to encourage the JEE Select thing as well. I do think world needs more public intellectuals but that's maybe another conversation, another day.

So, I thought I'd go on and say something about writing the manuscript.

> ➤ *Yes.*

❖ Okay. So, you've done the work, you've collected some data, of course you should start writing as soon as you have anything because writing is a form of thinking and it helps clarify your ideas. But as you are starting to put together more of a form of a manuscript, think about potential journals. We'll get to journal selection in a moment here but think about what their standards might be.

In education research many of us follow the "Standards for Reporting Empirical Social Science Research," published by the AERA, or American Education Research Association. The Standards, I think it's about a 12-page article in the journal called "Educational Researcher," in the August/September 2006 issue. So, that set of standards has everything that we followed at the "Journal of Engineering Education." It's very complete. It talks about the things you should include in your manuscript such as justifying your research design, justifying your sample or site if you're doing qualitative study, the people you've chosen for interview, why those are information-rich cases, justifying your methods, doing a thorough analysis, being aware of whether statistical tests are appropriate, affect sizes, methods for validity, reliability, trustworthiness, limitations, alternative explanations. So, all of those aspects are covered by those standards.

Other things, I found that daily writing really does work and one time I had about a month to deliver a manuscript. Of course, I had been asked three or

four months prior to that, but with everything else happening I had only a month left, and I applied that daily writing and sure enough it really did work. I was able to deliver a first draft on time. So, that's a testimonial to the power of daily writing.

> *I was going to ask you - People have different opinions about the length of time that daily writing should be. Do you have a point of view about that?*

❖ Well I think an hour a day is reasonable. And some days I had more than that and I would go for two or three hours and get into the flow as they say. Normal life is really busy, it's very hard to find that large block of three hours, but you can always find 30 to 60 minutes. And the idea of daily writing is that the topic stays in your brain and you can jot down more ideas and the important thing is the practice than the actual amount of time per day.

> *So, I know you've taught our graduate students about writing. So, I'm going to ask you a question that seems to be kind of a common misconception that some of our students have that writing is what happens after you've thought it all through. How do you help repair that misconception?*

❖ First is the exhortation to begin writing early in the process, whenever you have any stray thoughts, or even getting into the habit, journaling for example, informal writing is something that people do in the process of

doing research even before they've analyzed their data. And that also helps you develop fluency in writing.

There's a couple of things I do. I have an old saying, "I didn't know what I had to say until I've said it." I think that was from my brother-in-law who is a professional writer and editor. And I also use something that I learned from my colleague, Alice Pawley, that the paper, or manuscript, goes through multiple stages. So, the first stage is you're writing for yourself. It could be personal writing blogs, journaling, that you don't expect to show anybody else. And so, at that stage, just don't worry about grammar or punctuation or anything else; just getting ideas down, we used to say on paper but let's say on the screen.

Then the second stage of writing is writing for others. So, this is where you have versions of your manuscript that you're willing to share with others. And I do urge everybody to get informal peer feedback well before journal submission, that can really accelerate your progress. Even giving peers short pieces you can get feedback that you can leverage into other pieces of the manuscript. So, you iterate through that second phase for a while with your manuscript before you get to the third phase which is writing for posterity.

The transition from the second to the third phase is when it's ready to submit to a journal and you're ready to have really external peer review, get a lot of feedback, and have something that is worthy of, as Alice would say, "For Posterity."

So, three stages. Remember that what that implies is that you should be writing a lot all along the way. And that it's okay not to worry about how well you said it early on, it's just getting the ideas out and getting them organized. Then in that second phase where you're moving ideas around and you're drafting and redrafting to the point where everything is finally in the right order, more or less, and then it's ready for the external peer review and that process. Does that make sense?

➢ *It does make sure, yes it does, yes it does.*

❖ **Do you say something similar to your own students?**

➢ *Yes. Yes, they don't always believe me though. But I've heard a phrase that writing is a form of thinking. And to try to break that idea that, again you've got to know what you're going to say before you write it. Yes, yes.*

One of the things I've been think too is that, you know, words are so personal and for each of us they have so many meanings, but they're meanings that need construct individually. That you don't know if that's communicating unless you have people read it and give you feedback on it, "Do you mean this here or do you mean that there?" And how really valuable that is and how everybody needs to do that.

❖ **That's right. Right. So, in the academic writing course that you referred to, we read a couple of pieces. One is a piece by Steven Pinker called, "Why**

Academic Writing Stinks." He says it's the curse of knowledge that we know our subject so well that it's hard for us to imagine another person not knowing it as well. And so that's one of the reasons that the writing sometimes seems inscrutable.

And then we also read a piece by Darrell Behm, which is a chapter in a book called, "The Compleat Academic," and the title is "Writing the Empirical Paper." Behm says, "If the reader is confused it's the fault of the author. If the reader comes from the audience that the author is trying to reach, and is intelligent and experienced, and if the reader's confused then the author has not explained well enough for the person." So, that's where the author does need to take responsibility and go back and revise. That's why the feedback from peers of the kind of audiences you imagine is really important.

➢ *Right. Now one thing that you and I spoke about before that we haven't touched on yet I don't think is choosing a theoretical framework. Which I probably should have remembered to say back when we were talking about selecting the research project. But again, that tends to be something that is widely confusing to new researchers. "What? A theoretical framework? What's that? And how do I choose one, there's all these different frameworks?" What's your advice to people about that?*

❖ I'm not sure I have very good advice for theoretical frameworks. I do think it's important to be broadly read, so to be familiar with many different

theoretical frameworks. I think they're very useful. So, I'm very much a pragmatist, as many people in engineering are, and an eclectic, so I'll borrow from everywhere. I think it's important to have theoretical frameworks because they inform the research design and the data analysis, and it helps us be complete. So, if there are aspects of, let's say, self-efficacy which is of interest to you, make sure that you address each of the components of that construct. If your design is qualitative and you're doing interviews, that means making sure you have questions in the interview that address all of the constructs. And then sometimes the theory can help you start your coding dictionary. So, it just helps us be complete and it helps us think through things.

So, I find it to be a tool. In engineering education research, at the moment, we tend to borrow most of our theories, theoretical frameworks, from psychology, particularly educational psychology, sociology, and so on. And sometimes I see people combining ideas from multiple theoretical frameworks and make something that makes sense in their situation. So, I would say, yes be open to all the theoretical frameworks but have the courage to say, "This doesn't quite fit, let me develop something of my own. It'll be informed by what other people have done." And get peer feedback as well. So, sometimes those theoretical frameworks that we develop ourselves might be of use to not only other people in our field but also other fields and could be an export as well.

So, I guess you should have one. I don't have strong advice on how to choose the best one, it's just whatever seems to fit and helps you be

complete.

> *Right, right. So, Michael, are there any other hats you see lying around that you want to put on?*

❖ Well I haven't finished being the journal editor.

> *Oh, okay, sorry.*

❖ Many people do submit to the "Journal of Engineering Education" because, for some reason, they think it's particularly prestigious. It has relatively high impact that we are consistently on this impact factor measure. For readers who are not familiar with how it's designed, it is in simplified terms, the average number of citations per published article within the next two years or so; there's a more careful definition of that and there are variations on impact factors. But it's a very short window and it's number of citations per article. The "Journal of Engineering Education," has been publishing only 25 or 30 articles per year so our denominator is fairly small and so as a consequence the impact factor fluctuates a lot. And sometimes we have a very high impact factor, in fact one year we had the top impact factor among all education research journals, and sometimes we were way down in the noise there. We're usually in the top 10% among education research journals.

But the impact factor is an imperfect measure, it says nothing about the quality of a particular article, and in addition the "Journal of Engineering

Education," might not be the most appropriate journal. So, it's a matter of fit first. And so, I advise people to find something that fits.

Sometimes you can look at the references that you are citing because your article or your manuscript continues a conversation that's going on in those journals. Of course, you should check the journal's statement of scope and author guidelines, getting suggestions from colleagues. They may suggest journals that you might not have thought of. And as you look at these potential journals, check that your manuscript resembles the kinds of articles published there.

So, it's a matter of doing a little bit of homework; it's not that hard to look at the space of journals that might be interested in your manuscript. And if you're unsure, by all means contact the journal editor. I like to say, "Journal editors put on their pants one leg at a time like everybody else." We're people who are in the field and one part of our jobs is to communicate with the people in our field. So, that is something that I did enjoy doing, is communicating with potential authors. And usually by email, usually with the abstract, I'm not going to read the whole manuscript to give the feedback 'cause that's the whole point of peer review process. But that's definitely something people can do.

One more bit of advice is to avoid these predatory journals. You may have heard about them in the news. Basically, these are online journals, so all their published articles are accessible. And online journals generally have a cost model where the author pays; I mean, there are real costs. So, it's a

matter of who pays which costs and in online journals, typically, there's a fee assessed to the authors to defray the costs of publication. Well these predator journals will take your fee in return for publishing your paper without any real peer review. They'll often just promise a decision within two weeks, or 10 working days and they're just after your money. So, you can't get a thorough peer review in just a couple of weeks. Any reputable journal is going to take at least a couple of months. In the "Journal of Engineering Education," we tell people three to four months and we were able to get a decision within three months for about 70% of the submissions and within four months for about 90%, and I wish it could be for all of the submissions but delays are inevitable.

That's some advice on journals. Just because it seems to be fast doesn't mean it's appropriate. I guess I have a personal story about finding an appropriate journal.

➢ *Okay.*

❖ I wrote a paper with two graduate students, Brad Robins and Eric Johnson, and it was basically a scholarship of teaching and learning study of peer leaders and learning teams. And we submitted to a journal and it was rejected immediately because the executive editor couldn't find the research question. So, it was our fault; we had buried it. But we went onto another journal and we got a decision that advised us to revise and resubmit. We revised and resubmitted and it was rejected at that point. We went to a third journal and we got a decision within two or three

months and it was rejected then; fourth journal, fifth journal.

So, it was rejected five times before we finally found a sixth journal that published our paper and the editor thought it was pretty good. Well it was pretty good by then because, of course, we had used the peer review reports to improve the manuscript along the way. So, I do like to say that all good papers are rejected at least once; at least my papers. Maybe yours are not rejected at least once.

➢ *No, mine get rejected too.*

❖ Okay so, the peer review process is not just for gatekeeping purposes of deciding what gets published; but it is also for improvement. And when the peer review reports offer suggestions you also should take those seriously. You can disagree for good reason, but they're intended to make your manuscript better and more accessible. And so, we're grateful for the time that all of those reviewers put into our manuscript so that by the time we approached the sixth journal it sailed right through and got minor revisions; so, we fixed those up and it was published pretty quickly.

➢ *And that can happen with grant proposals sometimes too.*

❖ Absolutely. Some of my grant proposals were funded, well rarely on the first try, but usually after revisions, next rounds. So, there's a delay of six months or a year depending on the cycle of reviewing for whatever program you're going for.

> *So now, do you want to look around and see if there's any other hats?*

❖ **Being a professor, it's a wonderful life. As you know, I've been an academic for 38 years and I got into engineering education research relatively late in my career after 20 years. Which for some of the listeners may sound like an impossibly long time but I've been able to enjoy doing research in a variety of areas. I started doing theory of computing research, I pivoted as they say to engineering ethics, and this is kind of the third area of research. And that's the advantage of having a long career, and an advantage of having tenure. Being a full professor when I started doing this kind of work and I could just do whatever I wanted and that's the benefits of academic freedom.**

So, it's hard-earned, you do have to go through this process, for those of you who are academics and in academic careers. But I think it's so worth it; at least for me this is the way I've been able to contribute to the education of thousands, and thousands of engineering students, and dozens of people in engineering education myself.

> *It's a great career, that's for sure.*

> *Do you have any closing comments?*

❖ **Yes, I have some concluding advice for young researchers, particularly graduate students who are embarking on their dissertation projects.**

Conducting any research project, such as a doctoral dissertation, is a long, arduous process, sort of similar to climbing a mountain. And often it's best to have a mountain guide with you, that's usually your mentor, but you might be going with multiple people as well. Research is difficult because you're trying to learn something that no one has ever learned before. And that's why I say research is the highest form of learning. Now I think the results are always worth the effort but it's easy to become stuck or discouraged along the way.

So, my main advice is to surround yourself with a variety of traveling companions. So, some people should support and encourage you, often those are your friends or family. Fellow graduate students, they're your peers, they will be progressing through your career and through life with you. I'm surprised and pleased that I still maintain contact with people who were graduate students with me. We've all gone in our separate directions but it's always fun to see what they're up to; and we encourage each other.

The second group of people should challenge you to achieve more than you had ever thought you could. And usually, I as the advisor serve in the purpose and challenge them. Some should inspire you by their example. And some should help you have fun along the way. I tell all my undergraduates that learning should be fun, although my idea of fun is probably very different from theirs. Nevertheless, I feel there's a lot of joy in learning whether in an undergraduate class or in a research project. So, I wish all of you new researchers much joy along your journeys.

> *Well that is a perfect way to stop. And it has been a joy to speak with you, Michael. Thank you so much for sharing your wisdom with us.*

❖ **Thank you, Ruth. I am very grateful that you invited me to be part of your podcast series.**

> *And now you can be immortalized as you said, right?*

❖ **Forever on the internet.**

> *Yes, yes.*

> *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.*