Becoming an Engineering Education Researcher: Intersections, Extensions, and Lessons Learned Among Three Researchers' Stories

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Abstract - **Engineering education is an emerging discipline, and the number of people choosing this career path is increasing. What pathways might we navigate on our way to becoming an engineering education researcher? How can we investigate these pathways and what could we learn?**

In this paper we explore intersections, extensions, and lessons learned among three stories of becoming an engineering education researcher. We present these stories to facilitate scholarly discourse on pathways for becoming engineering education researchers and to seed the generation of a broader palette of stories through the reader's self-reflection on their own pathways.

The theoretical framework for the article is Bruner's (1991) "The narrative construction of reality." Narrative, through storytelling, is used as a method of inquiry to enable shared meaning making and common ground within a community of practice. In this paper, each author presents their story or personal journey of becoming an engineering education researcher in their own voice. By bringing the reader into our stories we seek to make visible and shared what we are collectively learning and to invite the reader to reflect on their own stories. For example, we observed many themes among our stories. Key among these is that we each began with a burning question that needed inquiry beyond our own sphere of expertise, and that (regardless of how long we've been on our paths) we see our journeys as ongoing. We conclude the paper with a discussion on potential roles for storytelling for building capacity in engineering education research.

Index Terms – engineering education research, narrative, pathways

INTRODUCTION

"We should look inward and think about the meaning of our life and its purposes, lest we do it in 20 or 30 years and it's too late." Robert Coles

There is a dearth of examples in the literature of engineering faculty members making a transition or, more specifically, embracing engineering education research. Among the few examples we found are *Balancing Acts: The Scholarship of Teaching and Learning in Academic Careers* (Huber, 2004), in which four faculty members (of which one is an engineering educator) present their stories of transitioning from a more traditional view on scholarship to one that encompasses the integration of teaching and learning. Similarly, the biographies and intellectual histories of thirty-five academic women who broke new ground are presented in *Academic Pathfinders: Knowledge Creation and Feminist Scholarship* (Gumport, 2002). Bateson's (2000) C*omposing a life* also includes fascinating stories of women on an academic path. At the same time, there is considerable interest within the engineering education research community for sharing and hearing the stories of others (Adams et al, 2007).

Since there are few, if any, stories of engineering faculty making the transition to engineering education researcher in the literature we offer our stories to enable scholarly discourse and hope that they will encourage others to share their own stories in making such a transition. We open with our personal connections to the role of stories in engineering education, an overview of theoretical frameworks on the role of narrative and a transition to developing engineering education researchers (i.e., finding their voice and telling their story). We then offer our stories in their original narrative form, discuss themes that emerged, and offer suggestions for others who are navigating engineering education researcher pathways. We conclude by summarizing the ways in which storytelling and narrative can play a role in facilitating engineering education research as a professional endeavor.

Each of us has been interested in the role of narrative. In 1998 Karl wrote a *Journal of Engineering Education* Academic Bookshelf column entitled "That reminds me of a story: The role of narrative in engineering education (Smith, 1998)." Although he had been interested in the role of narrative for some time, he was reluctant to submit a column on stories. Interestingly, he got more responses to that column than to any other of the 12 or so Academic Bookshelf columns he wrote.

Robin has been exploring the role of storytelling in engineering education from both a pedagogical and research

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perspective. With her colleagues from the Institute for Scholarship on Engineering Education (ISEE), she co-developed an interactive story poster session for helping engineering education researchers make visible and shared what they are learning (Adams et al, 2007). The session was first offered at the Frontiers in Education conference in 2005 (Adams et al, 2005) and will be offered a second time in 2007 with a particular focus on diversity and global engineering (Allendoerfer et al, 2007b). She has also been using storytelling as a research approach to investigating the process of becoming interdisciplinary engineering education researchers (Allendoerfer et al, 2007a).

Lorraine has been interested in students' stories, and especially understanding what brings them to engineering, why they stay and why they leave (Engerman et al, 2006). She has explored the varied voices of US born and International engineering students (Williams et al., 2007) and uses her classroom as a venue for exploring the pathways to becoming a global engineer (Fleming et al, 2007). She has also been a key collaborator with Robin on the ISEE storytelling projects.

WHAT'S IN A STORY?

The theoretical framework for the article is Bruner's (1991) "The narrative construction of reality." Bruner argued that sense making is mediation through "cultural products, like language and other symbolic systems." Here, narratives provide access to and enable discourse around embodied practices. Bruner defines narrative as:

- Taking place over some sense of time (e.g., a beginning and ending situated in time)
- Dealing with particular events.
- Having characters that have "beliefs, desires, theories, values, and so on" (e.g., they are authentic stories).
- Being interpreted in they can be discussed in terms of what they mean both personally and publicly.
- About something unusual that occurs (e.g., surprises, life changing events, transitions).
- Referencing reality by providing information on the nature of the situation that the narrative represents.
- Generic in that they can be classified as a particular genre.
- Supposing a claim about how one ought to act.
- Requiring a negotiated role between author and reader (e.g., they are a transactional activity for constructing meaning through discourse).
- Cumulative in that they become part of a shared body of knowledge.

Elaboration on these features can be found in Bruner (1991) and several of his follow up publications, such as *Making stories: Law, literature, life* (Bruner, 2002). As suggested by these ten characteristics, narrative is both a process and a construction of reality (as posited by the narrative). In other words, narratives are about learning – they teach us about the nature of reality as constructed by human minds, and help organize our own and other's experiences (Bruner, 1992). Narratives are also dynamic. As clarification, Bruner (1987, 2004) poses the question, "Does that mean that our autobiographies are constructed, that they had better be viewed not as a record of what happened (which in any case is a nonexistent record) but rather as a continuing interpretation and reinterpretation of our experience?" Finally, narratives are culturally and socially shaped through a process of translating private experiences into publicly negotiated forms. Related frameworks that support Bruner's ideas include Schank's (1990) claim that "knowledge is stories" and Polkinghorne's (1988) guidance on how to use research information organized by the narrative form.

One form of narrative inquiry is storytelling. Storytelling has a long tradition as a method for communicating and negotiating ideas (e.g., Bruner, 1986; 2002; Egan, 1995; 1999) and as a research methodology[4]. Storytelling involves the systematic collection of living people's testimony about their own experiences and is often used to make visible the experiences of people who may have been marginalized, hidden, or silenced. Some researchers have been exploring the role of story in teaching. As examples, the use of narrative for supporting reflective practice in teaching has a significant presence in the work of Robert Coles (1987, 2004), Nel Noddings and Carol Witherall (1990), and Parker Palmer's (1998, 2000) explorations of the teacher's life. More recently, there is an emerging literature on the role of stories in business and organizations (Brown, Denning, Groh & Prusak, 2005; Denning, 2004, 2005). For example, Denning describes how storytelling can be a strategy for igniting action, organizational change, knowledge transfer, and imagining new perspectives (Denning, 2000; 2004). Similarly, IDEO executives use storytelling to stimulate innovation (Kelley and Littman, 2005).

Situating these ideas in the context of engineering education research, narratives (via storytelling) can make visible culturally and socially situated knowledge, generate discourse, and enable the development of "common ground" (Bromme, 2000). Narratives may support both participation in and development of a community of practice (Lave & Wenger, 1991). As such, we draw on Bruner's framework to provide both the mechanism and the means for supporting an interdisciplinary knowledge building community of practice (Derry, Gance, Gance & Schlager, 2000). More specifically, we provide our own stories as a way of facilitating reflective practice and more importantly the co-construction of knowledge on the process of becoming engineering education researchers. Our goal was to convey who we are, where we came from, what we struggle with, and where we are going. Our thesis is that an increased presence of individual's stories about becoming engineering education researchers will help others understand this emerging field, provide guidance for their journeys, and encourage storytelling as an important aspect for constructing engineering education as a professional discipline.

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[4] http://www.ohs.org.uk/journal/

OUR STORIES

Robert Coles' (1989) *The call of stories: Teaching and the moral imagination* provides a useful point of view as you read our stories. Coles notes that stories, especially personal narratives help us develop a better understanding of ourselves and the experiences of others. "The whole point of stories," he writes, "is not 'solutions' or 'resolutions' but a broadening and even heightening of our struggles (p. 129)." Our hope is that these self reflections will help others who are on (or considering) similar journeys.

Robin's Story -There's no such thing as a detour, it's all progress on a never ending road

Fifteen years ago if you would have asked me about engineering education I would have wrinkled my forehead and asked "what's that?" I had just moved to Seattle and had every intention of completing my master's degree in materials science and scooting back to practice. I was sitting in Gretchen Kalonji's office and she was talking to me about her work with this project called the ECSEL Coalition. I remember my surprise at her doing this kind of work and how different it was from all the other faculty's projects (who talked about more traditional materials science projects). I had just spent a couple of weeks working with young kids at an Ocean Awareness Day Camp (my best friend's project) and I still had that buzz of being an educator. Gretchen was developing curricula for an introductory materials science class and she was really thinking out of the box with creating hands on laboratory experiences. I was intrigued, so intrigued that I started working with ECSEL and stayed with them for almost ten years. Over that span of time I had a lot of freedom to pursue (and sometimes create) opportunities to try on lots of hats – curriculum design, assessment, summer programs, working with K-12 educators, running workshops, and designing small research studies.

ECSEL became a place to explore – to ask questions about "why would early design experiences play a role in encouraging more young men and women to consider engineering" and "how can you measure the impact of large projects?" I realized that I enjoyed digging into the complexity of these issues – and that the answers to these kinds of questions were beginning to have more value for me than my traditional materials science work. ECSEL also became a home. I found myself exploring new ideas through the people I was meeting through ECSEL, and happily thriving in this strange network of engineering and education (mostly higher education) faculty and graduate students.

When I decided to take some classes in education, I didn't have a big game plan (after all I was busily working away on my materials science thesis) but rather played the butterfly of following where my interests led. I'll never forget my first classes in education. I was a "typical" engineer – I sat in the back of engineering classes and rarely asked questions. I always had beautiful notes! When I showed up in education on the first day all of the sudden I was asked to talk about myself and jump into the conversation. All I kept thinking is that I had no idea what to say, and I wasn't sure what everyone else is saying. I can't really remember my first epiphany but I do remember sitting in Geneva Gay's multicultural education class and hearing all the different kinds of education reform efforts – this never ending cycle of tinkering that can be strongly influenced by evolving political agendas. Wow! Education is incredibly complex and curriculum is only one part of this complex system. As a system there was much to build on and many questions to ask before jumping into a design for reform. As someone who identifies with a systems perspective – I began to realize that I had found a new intellectual home. In this home I found the questions more interesting, or perhaps more satisfying, to work on than just engineering.

As I took more classes, I found myself imagining a PhD with a focus on engineering education. I did some research and my options were limited. Although I had the support of my ECSEL colleagues, an engineering education dissertation in the college of engineering wasn't an option. An alternative was an interdisciplinary degree, yet this was still at a time where interdisciplinary degrees weren't highly regarded. Over in the college of education there was mixed interest. Faculty in the science and mathematics areas were concerned that there would be no career options – and encouraged me to find a secure career path such as working in K-12. I remember being disappointed over how narrowly "career" could be defined and how a goal of having security didn't seem to mesh with a goal of intellectual development. I knew that there were actually many options but perhaps they weren't traditional "academic" options. I was comfortable with a scenario of a somewhat undefined career because I could imagine many career directions. Through my work with ECSEL I could see that accreditation and recruitment issues would be hot topics in engineering education – and that professional careers might emerge. Through my work in industry I could see how a better understanding of social and human issues would be valuable competencies in engineering work. The many hats I wore in ECSEL showed me that I could tackle a variety of jobs and that it was more important to follow your heart (something I also learned from my family). My experience has shown me that opportunities can pop up all the time if you're intentional in your actions.

Frustrated, I turned to my friend Karen Paulson who asked me why I hadn't checked out higher education programs. Good question. As it turned out, this was the perfect community for me. Issues of engineering education are most often higher education and policy issues, and I could develop cognate areas that focus on learning and instruction. My advisor, Steve Olswang, had no problems with the "career" issue – he could imagine many career paths and pointed to medical education as an example of what you could do in the program. So I made the jump – and it felt right – not scary at all – actually quite exhilarating. It honored more closely who I was, how I think, and what I stood for. My early questions focused on recruitment and retention and now I was exploring these issues from historical, philosophical, psychological, and policy perspectives.

Granted, I hit a lot of bumps in the road. I was often singled out as the "engineer" among all these "educators", and I was playing in an area that was entirely different than engineering. Or was it? When I worked in industry I was constantly in a position of moving among different points of view (marketing, operations, and design) and using different kinds of systems. So, I had some synthesizer skills to fall back on – and had many opportunities to hone these during my PhD experience to the point that I became known as a "synthesizer" to my colleagues. I found myself constantly asking "how does this relate?" I was also very interested in design and creativity and these are also research areas in education. These are at the core of my identity as an engineer (and artist) and education gave me an opportunity to delve into these in new and unimagined ways (i.e., research!).

One of my biggest learning bumps in education was more of an epistemological transformation. As an engineer, this is a word I would have never used (much less understood). In my education classes they opened up the box and asked us to compare and contrast epistemologies. What you come to understand is that different approaches to inquiry are founded on different ideas about what makes a persuasive argument (and a significant question). Which as it turns out, also fits with my ideas about engineering design because you have to consider "persuasive to whom?"

My other big bump was moving from a rich community through ECSEL towards feeling like a "community of one" over in education. I had friends (good friends), but I didn't have anyone asking the same kinds of questions. At the time when I was seeking new people to interact with, Cindy Atman headed over to Seattle to start the Center for Learning and Teaching. I knew her from ECSEL and so I showed up on her doorstep to learn more about the center and how I could participate. With Cindy's interest in design I was able to put more of my earlier thoughts into action – and this has become a central research area. Through CELT I also meant Jennifer Turns and we would have these intense conversations – that helped me move forward on conceptualizing some ideas that have become the center of my research interests and perspectives. You come to realize that there are people in your life that open up new ways of thinking and that one of the most important things you can do is allow it to happen.

One of the things I cherish is working with others to help them develop research projects. Clearly it's a big part of what I do now at Purdue, but it all began with a conversation about an NSF center for teaching and learning proposal. Of the ideas on the table was a question around how to build the research community. I knew that there was interest and that many folks are working on the fringes or in isolation. So, when it became time to write the proposal I took the lead for what became the Institute for Scholarship on Engineering Education (ISEE). Three ISEE year cycles later, I've made new colleagues and friends, and delved more deeply into the nature of engineering education research (yes, all that stuff about rigor is in there) and the process of becoming an engineering education researcher. And so now the ideas of interdisciplinary and capacity-building have become new research interests.

So what was my path – bumpy but opportunistic, quirky but intentional and sometimes isolated but always situated in communities. I've learned to pay attention to emerging opportunities and continue to learn how to be an interdisciplinary researcher. I've also taken on a new goal of supporting others in living in (and navigating) this interdisciplinary space. I'm getting better at learning how to honor my passions (and letting go of old passions that no longer have meaning). As a new faculty member, I fully anticipate that my next challenges will involve finding balance and am fortunate that my family and colleagues are there to help me through the next leg of my path.

Lorraine's Story – Making a Difference in Students' Lives – How I Began My Engineering Education Research Career

I became chair of the department of civil engineering in 1994 at a time when enrollment was falling and falling fast. This situation was particularly troublesome because my colleagues in computer science and electrical engineering departments were seeing booming enrollments. Good students were enrolling but leaving after only one year. Something needed to be done to not only attract students but to also retain the ones that were already there. As fortune would have it, I wrote a proposal to the Department of the Navy to implement activities to increase the numbers of underrepresented minorities pursuing engineering degrees. It was funded … my first big grant for $1 million! I now was charged with intervening in students' lives to help them succeed.

The new project, with its clever title, the TRAGG (**T**ransfer, **R**esearch **a**nd **G**o **G**rad) program, was designed to attract transfer students (a previously untapped resource) to come to our civil engineering department, complete their undergraduate degree and then continue on to graduate school. We had designed activities that we knew were tried elsewhere and thought they might work with our students. They were not research-based interventions for at that time there were few, if any, articles in the literature on what worked to retained students in engineering programs. So for five years, transfer students were nurtured, provided scholarships, engaged in undergraduate research and were encouraged to go to graduate school. The enrollment increased slightly but who knows if it were a direct result of the TRAGG program. To some degree the program worked but how and why it worked remains unknown.

In 1998, I had another opportunity to design and implement an intervention program to increase the numbers of underrepresented minorities. This project entitled HUSEM (Howard University Science, Engineering and Mathematics Program) would focus not only on civil engineering students but on all students in the science, technology, engineering and mathematics (STEM) disciplines that we offered at the university. Once again, the program was designed based on what my colleagues and I thought would work. We did not take the scientific approach that we would have in our research work. We were awarded that grant and proceeded to intervene in the students' lives in ways that we thought would

work. Our assessment of the project indicates that it is working but because it has not been implemented as a well conceived research project it is hard to draw justifiable conclusions from the work that has been done.

At this point, I wanted very much to figure out what was the key to enhancing the student's interest in engineering and how do you retain them once they enroll. In other words, what activities and interventions really worked? In the midst of my efforts to bring understanding to these complex issues, I got a call from the late Denice Denton, who was Dean of Engineering at University of Washington at the time. She was putting together a team of researchers of varying degrees of experience to establish a Center for the Advancement of Engineering Education (CAEE). They were proposing to do research on how students become engineers and what factors affect their success. Wow!! I had been working for years trying to answer that question. Now I was part of a team of like-minded educators who were taking a scholarly approach to the answer. Here was an opportunity and I took it. Through the scholarly work of the Center, we will be able to describe the path to successfully becoming an engineer. With that information, I will be better able to design intervention strategies that might help to increase the number of future engineers, and for my particular interest, the numbers of underrepresented minority engineers.

During the time that I worked on TRAGG, HUSEM and CAEE, I remained a classroom instructor teaching junior and senior level civil engineering courses. As an instructor I began to use my knowledge and skills as an engineering education researcher to try to improve student learning in my classroom. In 2005, I applied and was selected by the Carnegie Foundation for the Advancement of Teaching as a CASTL scholar. As a scholar, I spent one year designing and implementing a scholarship of teaching and learning (SoTL) research project with the guidance of noted SoTL experts (including Pat Hutchings and Lee Shulman). I learned the benefits of using my classroom, my program, my discipline and my institution as my laboratory. My students became better learners and as a result I became a better teacher.

Today, my research focuses on improving student learning and understanding the engineering education experience particularly for minority students. I am examining questions like "How to better integrate the liberal arts knowledge into engineering design courses" and "What factors influence high achieving students to choose to forego the pursuit of a graduate degree in engineering."

In spite of the work that I am doing as an engineering education researcher, I still face the issue of my work being devalued by my colleagues in my home institution. "Is this really research?", they ask. Quickly followed by, "Is it rigorous work?" and "Should this type of work be done by engineers or left to the folks in the School of Education?" However, my favorite query from my quantitatively-focused colleagues is "Can you really get meaningful information from qualitative data?" Despite the fact that the National Science Foundation funds this work, I am a long way from convincing my colleagues of its value, worth and rigor. Nonetheless I

carry on. I have found a research niche that is not only exciting and rigorous but it can have significant impact in the lives of engineering students. For that reason I will continue on.

Karl's Story – From Naught to Engineering Teaching to Engineering Education Researcher to ?

During a scholarship interview prior to my first year in engineering school at Michigan Tech I was asked whether I thought I would teach. I replied "no" quite emphatically, since I wanted to practice engineering. My experiences working for a building contractor during my last two years of high school convinced me that I wanted to be an engineer. After graduating I was able to practice engineering at a Southwestern US firm, and although it was interesting, I wanted to continue learning and to find more challenges. During the masters experience I became deeply engaged in research and enjoyed it immensely. Also, I served as a TA for a couple labs to help pay the bills. After completing a master's degree in engineering I got a job in a research lab at the University of Minnesota. The research work was fascinating and I enjoyed the research enterprise – writing proposals, doing the work, participating in research seminars, attending conferences and presenting papers, etc. Also, I savored the academic environment! I was regularly encouraged by my colleagues to turn one of the research projects into a PhD project.

I merrily pursued the research path for a couple years when administrative changes eliminated the research-only positions (like mine) and I was expected to teach. Although it was over 30 years ago I remember my first teaching experience quite poignantly. It was a course in thermodynamics and kinetics of metallurgical reactions. I used the only model of the teaching and learning process I knew, I lectured and worked example problems, and of course, assigned and graded homework problems, and wrote and graded exams. Students repeatedly asked questions that indicated they didn't have a clue what I was talking about. It was very frustrating! I struggled to improve my lectures and explanations, but had the nagging thought that there must be a better way to teach than what I was doing.

I started taking evening courses in the College of Education, which was located right across the street from the research lab (proximity is wonderful). The courses on measurement and evaluation, psychology of learning, were interesting and helpful, but the course, Social Psychology of Education opened up a whole new world for me. It was the first time in a instructional setting where I experienced high performance teamwork with clearly structured positive interdependence and individual and group accountability. I was stunned and thought, "This is the way I worked as an engineer on the job and the way I work as a researcher, why not do this in undergraduate engineering classes."?

The experience in the social psychology of education class taught by Dennis Falk, one of David Johnson's PhD students launched me into applying for the PhD program in educational psychology. My engineering colleagues thought is

was very weird and cautioned that I would always be a second class citizen. I was so excited about the learning and research opportunities that I let caution go to the wind. The courses were fascinating. I was particularly influenced by the Psychology of Knowledge Acquisition and Small Group Procedures for Social and Organizational Change, and vacillated for awhile between studying expertise and cooperative learning. Finally I chose to study the role of controversy in cooperative learning groups. David and Roger Johnson welcomed me into their research efforts and provided me with wonderful mentoring and opportunities. I am deeply indebted to them for all their encouragement and support.

In the late 70s I began meeting other engineering faculty who were interested in engineering education. A conversation with Lee Harrrisburger, who my colleague Jim Holte introduced me to, had a big influence because he was someone who was thinking, researching and writing on engineering education. Although there weren't a lot of faculty in engineering who were actively involved in engineering education research, there were a few people in the rest of the University who were interested. Also the Director of the research lab, Kenneth Reid, was very interested and supportive.

The 1981 Frontiers in Education Conference was my first formal introduction into the ASEE ERM community. Dendy Sloan chaired the session I presented in and introduced me to many people. I don't recall all the folks I met that snowy meeting in Rapid City, South Dakota, but I think I met Dick Culver, Jim Stice, Billy Koen, Helen Plants, and many others whose friendship and colleagueship I've treasured over the years. I felt I found an intellectual home and a scholarly community.

I led a split life for the next ten years trying to do both engineering research and engineering education research. In 1991 the research lab where I had worked for almost 20 years closed and I moved to civil engineering where I taught civil engineering systems and project management and economics. My scholarly work was now primarily in engineering education, and I turned my attention to writing books and articles about teaching and learning. During the 90s I spent a lot of time working with faculty on teaching and learning, especially in the Early Career Teaching Program at the University of Minnesota and the Lilly Endowment Teaching Fellows Program at Michigan State University. I worked hard to bring a scholarly and research-informed perspective to the work with faculty. One of the highlights was spending over 10 years working as a Senior Consultant to the Provost for Faculty Development to help Michigan State implement Guiding Principle Number Two: Achieve More Active Learning.

In the past five years I've been much more involved in engineering education research, especially the Center for the Advancement of Engineering Education and in building engineering education research capabilities, especially through the Rigorous Research in Engineering Education project with Ruth Streveler. When the opportunity arose to join the Department of Engineering Education faculty at Purdue University I couldn't resist. It was just too exciting an opportunity.

And so, upon reflection I have not followed and am not following a traditional engineering academic path. Studying engineering education and practice has been an exciting 42 year journey since that fall of 1965 when I said I didn't plan to teach. The people I've met along the way that have encouraged me and supported me helped make it possible for me to persist on this path of doing what I thought was most important and that I was most interested in. I am grateful that they cheered me on, tolerated my deviance or treated me with benign neglect.

DISCUSSION – INTERSECTIONS, EXTENSIONS, AND LESSONS LEARNED

Our three stories represent early-career, mid-career, and late-career perspectives on the journey to becoming an engineering education researcher. The also represent academic lives lived in three different contexts – an engineering education department in a college of engineering, a traditional engineering department, and a split between these two contexts. Although our stories are not the same, a number of themes – or intersections – emerged. These include serendipitously discovering our passion, the lack of a sequential path and direction, complicated experiences with support or lack thereof, developing multiple identities, and dogged persistence.

We all had nagging questions that became our driving passions. In the recounting of our stories, we often used serendipitous language to describe how we came to understand our nagging questions or how we came to interact with others in our pursuit of our nagging questions. Even though our pathways differed, none of us had a straightforward path between our engineering undergraduate degree and our current status as engineering education researcher. In some instances our language suggests that we lacked a clear path or were comfortable with a meandering ambiguous path. When reading our stories we were reminded of experiences like walking through a meadow picking flowers intuitively creating a particular kind of bouquet. In other words, intentionality marked our pathway, while at the same time our pathways emerged through out actions (or our constructions of our stories). Our stories reveal that we each got quite excited about learning new things and about gaining new and different perspectives by interacting with members of other disciplinary communities.

A clear theme across our stories is our reliance on a mixed bag of support along the way. Interactions with individuals and communities appeared to be the literal backbone holding our pathways together. At the same time, we each speak of people who may disagree with our choices, choose to ignore our actions (e.g., "benign neglect"), or be outright hostile regarding our work. As such, it should not be surprising that we allude to having multiple identities. In some situations we proudly wear our engineering education researcher hat, in others we wear a cross-disciplinary hat of

bridging different paradigms, and in still others we wear our original engineering hat. This suggests that becoming an engineering education researcher involves constructing identities as engineers, educators, and engineering educators. It also suggests that success involves finding balance across these identities, integrating identities, and learning how to be facile with moving among them in different contexts.

Taking some steps back from our stories, we realized that we are all a bit tenacious. That we have a certain level of dogged persistence. As we worked to unpack this, we also realized that our stories suggest that we frequently adopt what may be called a "learner's stance" or a "researcher's stance". We each realized that our pathway involved walking into new domains with new rules and walking away from our comfort zones. In the process we enhanced our abilities of observation and synthesis in ways that we hadn't appreciated. More importantly, we appreciated how these experiences brought new life to our identities as life long learners.

EXTENSIONS

Navigating a career in the academy, especially for an early-career faculty member is often a treacherous journey even in traditional, well-defined disciplines (Rice, Sorcinelli and Austin, 2000; Trower, Austin and Sorcinelli, 2001). Extending beyond our personal narratives, there are a number of resources for successfully navigating academic careers (e.g., Sorcinelli, 2000; Diamond, 2002, 2004; Diamond and Adams, 1993; Smith, 2000, Wankat, 2003). While useful, many of these resources are not as readily available to early career faculty. In addition, guidance for navigating the challenges of interdisciplinary academic pathways (particularly interdisciplinary pursuits that bridge different epistemological perspectives) is scarce. However, research is beginning to emerge on how people enter, navigate, and work in the interdisciplinary engineering education research space (Allendoerfer et al, 2007). Aspects of this research resonate with our stories such as the prevalence and importance of community, the role of nagging questions, the importance of following your passion, and a tendency to frame steps along a pathway in terms of luck, chance, or serendipity. Other research highlights the cognitive challenges of formulating research questions, navigating the existing knowledge base, learning a disciplinary languages and paradigms, and analyzing data about how people learn and experience educational environments (e.g., Adams et al, 2007; Borrego, 2007). As we consider the growth in engineering education research endeavors (Haghighi, 2006; EERC, 2006; Smith, 2006; Streveler and Smith, 2006), any effort that makes the process of becoming an engineering education researcher more transparent has high value. In particular, there is compelling evidence that there is significant interest among engineering faculty as well as graduate students in pursuing engineering education research careers. The high number of applicants for such "capacity building" programs as the Rigorous Research in Engineering Education (RREE) project (Streveler, Smith and Borrego, 2007), the Institute for Scholarship on Engineering Education (ISEE) (Adams et al, 2007), and Bootstrapping in Computer Science Education (Fincher & Tenenberg, 2006) illustrate the incredible level of interest in engineering education research. Over 250 national and international faculty, professional staff, and graduate students have attended these programs, and many more were clamoring to participate. All of these new engineering education researchers have stories to tell, and stories they want to hear (and learn from).

LESSONS

What guidance might be offered for these new engineering education researchers? As we look across our stories, the following lessons emerged:

1. Find and follow your dream. This age old advice may not only be relevant for faculty who are considering becoming engineering education researchers, but for engineering in general. A message about engineering that reportedly resonates with teenagers is "Because dreams need doing." (Baranowski and Delorey, 2007). Dreams are challenging – they're also energizing.
2. Find and build community. Look beyond your immediate colleagues to combat isolation, build social networks, and create opportunities to learn. Look down the hall, in the next building, across the campus, to another school in another state or country.
3. Do your homework. Become familiar with engineering education research and be open to allowing your ideas about research to evolve. You'll find it challenging, but not insurmountable.
4. Remember what it's like to be a student – be open to learning and the associated rewards and challenges. You'll feel like the new kid in a place where the rules feel different - knowing all the answers is not the goal as much as knowing how to find answers.
5. Find balance. You'll feel like you have multiple identities – the trick is finding places of synergy (e.g., being an educator and an education researcher, finding a community of like-minded folks).
6. Be an architect of your own career. There are many paths and many useful bumps in the road. Learn how to see and leverage opportunities as well as find your own rewards – both intrinsic (e.g., being a better teacher) and extrinsic (e.g., students learn better).
7. Wear your researcher "lenses" at all times – see your class, campus, state, as a potential research laboratory. Nagging questions can be turned into researchable questions that have practical value (e.g., why is this happening, why aren't there more students, etc.).
8. Use research as an opportunity for reflective practice.

Please remember that these lessons are heuristics, that is, they are reasonable, plausible, but not guaranteed to work. However, according to Billy Koen's (2003) definition of the engineering method – the use of heuristics to cause the best possible change in a poorly understood situation within the

available resources – they are what we have for now. We hope our reflections helped advance the State of the Art.

CONCLUSIONS

Nathan McNeill, an Engineering Education PhD student at Purdue University remarked during one of the early sessions of the Leadership, Policy and Change course that "There is a dearth of engineering lore." There is lots of lore about artists, writers, scientists, medical doctors and lawyers, but remarkable little lore about engineers. Similarly there is a dearth of engineering education researcher lore.

In this paper we attempted to provide some lore. We hope our stories resonate – that they provide fodder for considering your own story and pathway and that the threads among our collective stories will be what hold us together as a community – because they'll be indicative of what engineering education research is as a professional endeavor.

So what's in a story? Stories are discursive acts – they are mechanisms for sharing, exploring, and reflecting on your own story and how they intersect with the stories of others. As such, stories are gathering places for building common ground around what it means to be and become engineering education researchers. Stories can seed more stories and enable change. Stories can demystify the mysterious by making visible the intentions in our actions and illuminating life lessons. Finally, stories can be a form of pedagogy, reflective practice, and research inquiry. What's involved in telling your own story? There are many resources (Denning 2004, 2005). Compelling stories cover essential factual information on the situation and characters, have coherent storylines with plots and resolutions, and engage the reader in the storyteller's experience. We conclude with another connection to Bruner (1986). The two quotes below from *Actual minds, possible worlds* capture many essential ideas from this paper, as well as indicate that there may be an emerging research area.

"So 'great' storytelling, inevitably, is about compelling human plights that are 'accessible' to readers. But at the same time, the plights must be set forth with sufficient subjunctivity to allow them to be *rewritten* by the reader, rewritten so as to allow play for the reader's imagination." (Bruner, 1986, p. 35).

"In the end, then, the narrative and the paradigmatic come to live side by side. All the more reason for us to move toward an understanding of what is involved in telling and understanding great stories, and how it is that stories create a reality of their own – in life as in art." (Bruner, 1986, p. 43).

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