

# Transitioning from Engineering Practice to Engineering Education Research: Lessons Learned from Four Researchers

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## Abstract

### Context

The field of engineering education research is still emerging and draws people from many career paths and backgrounds. This paper focuses on the stories of four researchers who came from engineering practice.

### Purpose or Goal

This paper explores the stories of four researchers who transitioned from engineering practice to engineering education research. The research question is: What was the transitional experience from engineering practice to engineering education research, and how have their experiences been impacted by their background in the industry?

### Methods

First-person accounts are presented as stories that span the early years of engineering education to the present from a large mid-western public university in the United States. The approach is modelled after Adams et al. (2007) and includes a summary of themes of similarities and differences analyzed by a fifth author.

### Outcomes

In 2007, Adams et al, challenged the community to share stories and this paper continues that approach and gives glimpses into differences from early years of engineering education to the present. This paper prompts scholarly discussion, sharing of stories and lessons that can be learned as we seek to create a diverse research community.

### Conclusion

We conclude by highlighting the importance of stories as humans are social beings who live a storied life. We provide the readers with different perspectives of transitional experiences to engineering education research from engineering practice that includes opportunities and challenges including the language, methods, and culture of engineering education research and how this community is different from practice.

**Keywords**— Transitioning, engineering education research, engineering practice

## I. INTRODUCTION

ENGINEERING education has become a recognized field of study globally, albeit it is still emerging in several regions (Borrego & Streveler, 2014). A notable challenge in this burgeoning area is the preponderance of researchers primarily grounded in engineering disciplines rather than educational

theory, thus encountering the arduous task of acquiring fresh expertise and viewpoints conducive to pedagogical research (Beddoes, 2014; Borrego & Bernhard, 2011)

The path of transitioning from an engineering academic to an education researcher is seldom documented, creating a void of representative narratives in the existing literature. A handful of resources offer a glimpse into such transitions, including ‘Balancing Acts: The Scholarship of Teaching and Learning in Academic Careers’ (Huber, 2004), where one engineer amongst four faculty members delineates their journey towards a scholarship that accommodates teaching and learning perspectives. Additional insightful narratives are encapsulated in ‘Academic Pathfinders: Knowledge Creation and Feminist Scholarship’ (Gumport, 2002), and the reflective accounts in ‘Composing a life’ underscore the experiences of women forging their academic paths (Bateson, 2001).

Despite the sparse literature on such transitions, there is a vibrant curiosity and eagerness to learn from the journeys of their peers, fostering a community grounded in shared experiences and stories (Adams et al., 2007). Recognizing this, we aspire to share our personal narratives of navigating from being engineering faculty to becoming engineering education researchers. Our aim is to stimulate scholarly discussions and embolden others to narrate their trajectories.

As we unfold our narratives in this paper, we will delve into the pivotal role stories have in sculpting the landscape of engineering education. Following an introduction to theoretical frameworks concerning narrative’s role, we will transition to discuss the journeys to engineering-education researchers, embodying finding one’s voice and articulating their story with authenticity. Emergent themes from the experiences offer valuable insights and guidance for others on similar paths. We endeavor to underline the potential of narratives in not only sharing individual stories but also in cultivating a rich repository of shared wisdom and experiences.

## II. LITERATURE REVIEW

### A. Narrative Research

Narrative inquiry takes various forms, one prominent one being storytelling, a method deeply rooted in human history for

conveying and discussing ideas, and as a vital research methodology, drawing upon established foundations laid out in the works of Jerome Bruner (J. S. Bruner, 2003, 2009) and Kieran Egan (Egan, 1993, 1999). This technique hinges on gathering firsthand accounts from individuals, offering a stage for voices that have previously been overshadowed or silenced, bringing to light a spectrum of experiences, including those of the marginalized.

In the sphere of engineering education research, one recognizes the pivotal role narratives play in unraveling culturally and socially contextual knowledge, fostering discourse, and building a shared “common ground” (Bromme, 2000). Moreover, it paves the way for nurturing a collaborative community of practice, a concept reiterated by Lave & Wenger, (1991) and fosters an environment conducive to interdisciplinary knowledge sharing and construction (Derry et al., 2020), drawing upon Bruner’s seminal framework.

#### 1) *The Foundations of Narrative Research in Education*

Narrative research, deeply rooted in qualitative and interpretative traditions, has been increasingly acknowledged as an indispensable tool in the field of education. It serves a dual role as both a phenomenon under study and a methodological approach, thereby presenting a rich yet complex landscape for educational research, encompassing various studies such as case and biographical studies (Connelly & Clandinin, 1990; Creswell & Poth, 2016; Goodson, 2014). Teachers are seen as innate storytellers, shedding light on the significance of narratives in the educational context (Connelly & Clandinin, 1990).

#### 2) *Bruner's Perspective on Narratives*

Jerome Bruner has emphasized the intricate structure of narratives and their role in shaping realities through symbolic systems and cultural products (J. Bruner, 1991). He contended that narratives foster a deeper understanding and create vibrant frameworks for analyzing learning processes in educational settings, thus acting as fertile grounds for pedagogical development. It is crucial to leverage this understanding in engineering education research for a nuanced exploration of learning landscapes. Bruner's further insights into the narrative construction of reality underscore the pivotal role of cultural products, such as language, in facilitating sense-making processes. These narratives unravel complex learning processes by depicting characters navigating unprecedented scenarios, guided by discernible beliefs and values (J. Bruner, 1991).

This paper seeks to harness the power of storytelling to facilitate a deeper reflective practice, aiming to contribute to the collective understanding and knowledge base of emerging engineering education researchers through the rich tapestry of our personal narratives. By sharing our journeys, the hurdles we faced, our origins, and envisioned paths, we aim to foster a vibrant community grounded in shared experiences and wisdom. We aspire to delineate the emerging field of engineering education, guiding newcomers in their trajectories

and enhancing the discipline's profile through a rich tapestry of multifaceted narratives.

### III. METHODOLOGY

#### A. *Research Design*

The primary methodological approach adopted in this research was qualitative, seeking to draw out rich, detailed narratives from participants via structured interviews. The study was rooted in an interpretative paradigm, recognizing that the knowledge garnered would be constructed through the dynamic interaction between the researchers and the participants.

#### B. *Participants*

Four participants were engaged who all made the transition at the same large Midwestern University in the U.S. but came from diverse backgrounds and in different eras.

#### C. *Data Collection*

##### 1) *Interview Protocol*

Participants were sent an email set of prompts, which allowed the participants to respond at their convenience within a stipulated timeframe. The email format also had the benefit of automatically documenting the responses, facilitating a transparent and straightforward data collection process. The prompts were developed to guide the participants and were crafted to facilitate deep exploration into the research questions. The participants were encouraged to freely articulate their thoughts, experiences, and reflections. The final protocol included the following questions:

1. Please describe your background before you entered the field of engineering education or started to be involved in engineering education research.
2. What got you into engineering education research?
3. What motivated you to transition from practice to engineering education research? What interests you in engineering education research?
4. Why research in engineering education and not in a technical engineering discipline?
5. How did you find the engineering education community vs. technical engineering community?
6. After your transition from practice to engineering education research, what was the transition like?
7. Please describe your current work in engineering education research.
8. Please describe the direction in which your current work is headed.
9. Are there things that engineering education can do more? Talk about lessons learnt or limitations the field has as of now that needs to be addressed.

#### D. Data Analysis

In the post data collection phase, our focus pivoted to analyzing the gathered data to unearth patterns and derive insights from the narratives of the participants. This involved a structured approach, where we meticulously went through the process of familiarizing ourselves with the data through repeated readings of the responses, a methodical exercise that set the stage for a detailed thematic analysis.

A three-tiered coding strategy – open, axial, and selective coding was applied through which we were able to cultivate an understanding of the narratives, leading to a structured, yet nuanced interpretation of the data at hand. By progressively building upon each stage of the coding process, we aimed to present a well-rounded analysis, grounded in theory and detailed observation, that unveils the intricate patterns and central themes vividly portrayed in the participants' responses.

### IV. OUR STORIES

#### A. Empathy in Engineering: Nusaybah's Transition from Software Development to Engineering Education.

My background is in Electrical and Computer Engineering. After graduating with a bachelor's in computer engineering, I worked as a software developer for two years. In industry I realized that although I gained knowledge and experience, I was not satisfied. I wanted more out of my career. I went on to pursue my master's in electrical and computer engineering with the goal of transferring into academia. While I was working in industry I was also teaching a coding course, and I enjoyed that more than my actual full-time job. Fast forward to today - I am in my current position in EPICS as an instructor for 7 teams (subdivisions) and the coordinator for senior design.

While teaching, I was really interested in how students learn. How you can teach the same material, but one student will get it, and another didn't. Or how from semester to semester, you had to adapt your teaching. Because, what working one semester, may not work the same the next. So, learning, the process of learning, the dissemination of knowledge really intrigued me. Especially with my background in ECE and looking back to how I learned. I struggled in the field, but that was the status quo – you had to struggle in engineering. You had to earn it. That was the mentality. I want to change that.

I went from practice to education because the job was more satisfying. I love teaching. I love touching the lives of the next future engineer and having an impact on their learning and outlook. Over time, my interests changed. I became more interested in the learning process than technical aspects of ECE. The engineering education community is more like a family. They were more welcoming and understanding. Kind and inclusive of all. Never saw that in my experience in ECE. I think the transition came easy to me. Like I stated before, the shift was due to my interests, so everything flowed naturally in the direction of engineering education research. I think the only

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shock to my system was the lack of equations. Coming from the engineering technical background, and not needing my fancy calculator or a script to run over night or debugging code hours on end to find you missed a semi-colon...that was the biggest difference. No numbers, no code, no equations. And at first, I missed that life of ECE. There was too much I didn't know and didn't understand in engineering education. Having epistemology, methodology, frameworks, etc. thrown at me felt like I was in a foreign world. But like I said before, the community was beyond understanding, kind, and welcoming. So, I think after the first year of courses, my equations were left behind and really didn't mind any more.

My work in engineering education research has been focused on community-engagement in engineering. My current work focuses on empathy in engineering. Specifically how community engaged learning can help engineering students develop their empathic skills. Empathy is very important for engineering design, yet most don't think of 'empathy' when you talk about engineering. Research shows that by empathizing with stakeholders, engineers design more innovative solutions that focus on actual needs, discover new product applications, and avoid future mistakes before wasting money and resources. I want the field to shift to be more understanding of others. For them personally, for their work as an engineer, and for the world as a whole. I think my lessons learned really focus on me personally – I just wish I had exposure to this field early on. I think I would have found this home and begun this journey a lot earlier if I knew what engineering education research was and the possibilities.

#### B. The Story of Researcher B: From [Aerospace] Engineering to Educator and Innovator

I worked for a little more than five years in a [aerospace] company in aerodynamics and math modeling simulation. My degrees were in mechanical engineering, from a university that kept mechanical and aerospace completely separate. But I figure that my degrees proved that I could learn, and they wanted to teach me how they build their products, which is a different philosophy from other competitor companies. I learned engineering design and management philosophies. I participated in the flight test and then the process of making sense of the data that ultimately improved the flight simulator for pilot training.

I felt like I was drowning in uncertainty for 2 years. I learned aerospace-related skills on my own time and money to be useful in my job and to reduce my uncertainty, which my supervisor fully supported. And I was a teaching assistant briefly in my master's degree. I enjoyed teaching, but I was clear that I didn't know enough about it and that my degrees still left me unconfident in my own engineering abilities and knowledge. I wanted to bring practical experience to the classroom. And I would be

fully vested in my 401(k)-matching money after 5 years of employment, so after 5 years, I started looking for PhD programs. The threshold for teaching at a university is usually a PhD. So I wanted a plan of study that could address how to learn and teach engineering, even if it was a secondary objective.

I will admit that I stumbled into my eventual PhD program. I didn't pursue a technical engineering discipline because I didn't know how to resolve master's research in heat transfer and nanotechnology with my work experience. I felt that I had equal proficiency in both. Also, I wanted to move somewhere else in the country, but did not have a definite choice yet. But I used the school's website to look at PhD programs offered. I landed on the Engineering Education page and eventually set up a face to face visit, where I met my advisor, who strongly advocated that I join the program. I had an epiphany that our PhD program would not intentionally make us better teachers. But I have always known that PhD programs must have research, so I stayed in the program.

When the university hired a new person for the chancellor/president role, that's when fundamental differences between pure academia and private industry workers became clearer. Academic leadership changes look like leadership changes in private industry to me, but now I know that not everyone holds this view. Even more differences between academics in engineering education research and in technical engineering became noticeable when I took a teaching role in engineering. I didn't understand the value of some social science courses in Engineering Education until 3 years after, so these weren't enjoyable while I was enrolled. However, I took an adjunct teaching position at a teaching focused university. When I started talking with these colleagues about designing classes and assignments and grading schemes, it was clear to me then that we had different philosophies about who should be an engineering student, because we deliberately researched engineering students' attributes and attributes of institutions and systems that influence students' recruiting and enrollment.

And now that I am on tenure track, I have mixed feelings about obtaining tenure. The decision-making structure in academia is exactly upside down compared to private industry. In private industry, top level leaders are supposed to use data to make decisions and it flows down to the lower levels. In academia, decisions are made by Roberts Rule of parliament voting at the department level and is supposed to flow up to higher levels of leadership. Since I started in private industry, I learned its decision-making structure and I prefer it over academic decision-making structure.

I have thought much about how my academic salary accounts for my industry experience, and vice versa. My

industry experience to my department was a "nice to have" that did not get counted as credit on the 6-year path to tenure. But my colleagues who taught as adjunct in that institution or as tenure track at other institutions did receive credit. I have to think about money to take care of my family and my retirement. I do feel that my salary has lagged behind others in my age group with engineering bachelor's degrees.

But I also love teaching students, and I take some pleasure in research. I also still love tinkering, inventing, writing, and engineering. My institution is teaching focused. But we're experiencing a drop in enrollment and over 75% of our budget is from tuition. So we are strongly encouraged to bring money in. I tried a couple of avenues but so far, my proposals have been rejected.

By happenstance, a fellow classmate is now working at a government institution and just started up a research competition ([research competition]) where the undergraduate student winners would be offered a summer internship. This alleviates the need for me to generate my own research questions. This summer, I am working with 1 student, an incoming sophomore who loves using - a prescribed engineering design process that I learned in my PhD studies and has said that she has learned more with me than all her other classes, and she's so grateful.

Based on my pleasant experience with my student in the [research competition], I think I can offer this undergraduate research class annually. We have broad topics published by [research competition], and I help the students narrow the project to an actionable plan, according to their interest. It is applied research (technology readiness level 3 to 6 on a scale of 9), not fundamental research. I can write papers that are classified as "scholarship of teaching and learning" but I might not need external funding to conduct this type of research. For example, I just used the grading data from my own classes to write an engineering education research paper.

I took the qualitative research avenue. It really worked for my dissertation questions. But I believe that our technical only engineering colleagues assume it's all social science research in Engineering Education. It works both ways; technical engineers who teach can conduct technical research and engineering education research, and engineering education researchers can conduct technical research, too. But engineering education research is its own discipline. Some engineering professors assume "I teach, I research, I am an engineer. Therefore, I am an engineering education researcher". They see each word in the title as separate and unrelated activities. But we in the discipline know that we lacked a unique word in English to name the discipline. Maybe if we were "engi"-gogy instead of pedagogy, then perhaps others on the

outside would not claim to be in our discipline. That by itself may cause them to ask Engineering Education researchers what exactly we do, and that's a great conversation starter.

### *C. Paul's Journey: From Structural Engineering to Pioneering in Engineering Education Research*

As a first-generation college graduate, I received my Bachelor of Science in Architectural Engineering from the Milwaukee School of Engineering and Master of Science in Civil Engineering from the University of Illinois at Urbana-Champaign. In both cases, I specialized in structures. Following this, I gained six years of industry experience in structural engineering consulting, becoming licensed as a Professional Engineer in the state of Colorado. Through this experience, I had the opportunity to work on transit hubs, high-rise towers, stadiums, university buildings, embassies, and high-end corporate facilities. For much of this time, I specialized in complex construction erection engineering, serving as the full-time staff engineer for this scope on an award-winning project that used the largest number of simultaneous stand jacks ever in the northern hemisphere, for example. Throughout my academic and professional experience, I had actively participated in and led community-engaged engineering and design projects for approximately a dozen years with a number of organizations before starting my PhD.

I have had a long-standing interest in topics related to education and, in particular, experiential learning. My curiosity in this space was sparked first when I attended an experimental new local public middle school which had a strong emphasis on project-based learning and multilevel education. Here, I participated in my first experience with what I would now know to call a community-engaged design project. Through the remainder of my education, I maintained involvement with this interest through serving in tutoring and teaching roles of various kinds, including teaching English to international students while studying abroad and taking on the role of co-instructor for a course in the Learning in Community (LinC) program at University of Illinois Urbana-Champaign (UIUC) while a graduate student there.

Throughout my time at university and in the workforce, I also had the opportunity to participate heavily in the organization Engineers Without Border USA (EWB-USA), which has a dual mission around projects that empower communities and equip leaders. Through my experiences with this and other similar organizations as well as within the industry setting, I found myself more and more drawn to the topics surrounding how the engineering and design project stakeholders are prepared, supported, and coordinated in the pursuit of objectives, beyond the specific technical details required for a given scope of work. I also observed what I perceived to be wide variations in the approaches taken and outcomes achieved by various groups over time. These experiences and observations drove me to want to learn more, create new actionable knowledge, and these

cement high-impact positive practices in this spaces of experiential learning, civil engineering, community engagement, design, and engineers in professional practice. As I would come to find out, this basket of topics would fit nicely in the world of engineering education research.

The primary event which precipitated my decision to actually leave working in industry and begin my PhD in engineering education was finding a PhD advisor who I thought would be a good fit for me, in terms of research interests, industry background, funding, logistical support, and affiliated program and institution. For much of my time working in professional practice, I had been slowly exploring the possibilities of pursuing a PhD, through reaching out to faculty, having conversations with graduates, and the like. Many of these probes helped clarify my search path going forward and finding an opportunity that made sense was critical to deciding to pursue engineering education research. I enjoyed being a structural engineering practitioner, but I thought there was a good chance I might be able to find greater wellbeing and fulfillment working in engineering education. The day-to-day nature of the work appealed to me as well as the long-term goals I would be able to focus on. Ultimately, encouragement from those close to me and specific expressions of interest from my to-be advisor are what put me over the edge to take the risk to explore a new career path.

Throughout my career, I had an interest in widening my perspective and interacting with broader aspects of design projects. This was heavily influenced by the nature of my work as a leader in community-engaged engineering projects and organizations as a volunteer, where I had an opportunity to focus on people, projects, and process management. This was a significant factor in my move from working on new building design to construction engineering in my professional work as well, and I see pursuing a specialty in engineering education as a continuation down this path. I was also very interested in increasing my ability to address different types of challenges. Becoming more specialized in my existing technical area was not in line with this. Instead, I sought to widen my horizon and increase the potential leverage of my efforts by working to improve the human elements of engineering and design endeavors, doing so by supporting the empowerment of others who could have a much greater impact over many fields compared to my direct technical work on specific items.

Both of these communities [Engineering Education and Technical engineering] are expectantly large, and I can only speak to the small portions with which I have interacted. That said, the communities are naturally impacted by the environments and incentives that influence them. The largest cultural difference I have noticed between the two groups, as I have experienced them, is that the technical engineering community tends to be much more narrowly focused on their area of expertise while the engineering education community is

generally open to casting a wider net and seeking out broader perspectives.

Like one might experience when traveling in a different country from one's home, a change in environment can help illuminate those things we take for granted as well as inform us about which aspects of our experience might be more universal and which are not. My transition brought to the forefront the diversity in ontological and epistemological lens. The timescale of most tasks I have encountered in academia are more extended than those I was accustomed to in engineering consulting, with lower concentrated intensity. Due to this and other environmental factors, the ways in which people prefer to go about collaborating on tasks can be quite different. I would say my experience in both teaching and research has aligned in some ways with the pace and procedures of my previous engineering work, but that they do so in different ways. Much of what is done in the two spaces is very similar, just with different specific content knowledge and contexts. The professional skills required and design approaches to problems are all much the same in my experience. This makes sense when we think about the idea of the T-shaped professional. Most of the items at the top of the T are common between the spaces and can be transferred reasonably easily, I think.

Transitioning from being a highly valued member of a professional team to being a new person in an academic program was a significant adjustment in terms of how people viewed and treated me. My previous experiences were often not valued by those in the engineering education spaces and I needed to prove myself in this new arena. Working with people mostly approximately my age or older in professional practice and then joining a program in which many of my classmates were up to a decade younger than me was a meaningful cultural adjustment as well. Finally, the reading and studying styles that worked well in my previous engineering coursework were no longer appropriate for the classes in engineering education; accepting this and learning new methods took significant time and energy. I found making connections with others who also had previous industry experience expectantly helpful; establishing ways to make these connections easier to find and build would be a positive development, I think. Also, broadly speaking, the whole system of how universities compensate graduate students for their work is also something that should be reviewed; I think changes here could help those coming from industry but also go far beyond this. After getting used to the new environment, I find the work much less stressful while still interesting and engaging. Academic life also affords the opportunity to meet many new people and explore fascinating ideas to an extent far beyond my experience in engineering practice. The flexibility in how I decide to manage my schedule is also a benefit in my view.

My research interests remain in the areas of experiential learning, civil engineering, community engagement, design, and engineers in professional practice. I often prefer to take a

mixed methods approach to research questions and may be described as an action researcher, given my great interest in connecting scholarship with practice. My specific work at this time covers a number of areas centered around community-engaged learning. This includes creating a new Model for Project-Based Community Engagement, writing about various case studies, and beginning work on an alumni study of former EWB-USA student members.

The EWB-USA alumni study is intended to serve as my dissertation topic over the following two years. In addition to this, I am interested in exploring opportunities to investigate the teaching, coaching, and learning of design as well as continue to publish on practical aspects of conducting experiential learning in the design space, such as looking at assessment methods. [As far as it pertains to the lessons or limitations] Focusing on and valuing more highly the transition of scholarship to practice. Many of the largest challenges in engineering education appear to be matters of execution. Build better understandings of the differences between specialties within the very large and ill-defined space of engineering, targeting scholarship to the individual disciplines as appropriate. Connect and engage scholarship and student learning more with professional practice and the broader community.

#### *D. Bill's Journey: From Aviation Design Engineer to Pioneer in Engineering Education Research*

I graduated with a master's in mechanical engineering and entered a career as a design engineer in aviation. I loved the work and the industry and was selected to be a corporate recruiter which got me back to campus. The recruiter role opened doors to speaking to engineering classes and working on how to transition students into their professional careers. I found these parts of my work very interesting and saw the gaps in education that I thought I could help address.

To be a professor I needed a PhD and began with the goal of doing a traditional faculty path with technical research, teaching and service. While I was in the PhD program at Purdue University, I met Prof. Jim Jones who was doing innovative work in education and was a leader in active learning, assessing the impact and publishing on the work. He invited me to be a part of a group of graduate students who would become the first ASEE student chapter. ASEE was not initially enthused and we had to advocate and were successful. That changed my thinking about a traditional Mechanical Engineering career. An opportunity opened to join what was called Freshman Engineering, at first as a visiting assistant professor and then as an assistant professor. Those positions were focused on teaching, advising and service. As a former head advised me, those positions had a viable path to tenure but likely not to a full professor and the pay and respect from other faculty would not be high. That meant that I would spend a career as an underappreciated (by peers) associate professor, underpaid in

engineering and have the opportunity to impact thousands of first-year students. I thought that was exciting.

The idea of doing educational research was not on my agenda at first. However, Professors Goranka Bjedov and George Bodner would change that. Goranka was an associate professor in our department and brilliant. She was the leader of a large multi-college grant between engineering, science and math and I was included as a co-PI. She was so brilliant that she left our department and went to work with one of the largest tech companies on the west coast. This left me as a lead on the grant. Prof. George Bodner was a distinguished professor in Chemistry Education and also on the leadership team for the grant. He saw the opportunity with the grant funds to do significant qualitative work with first-year students and faculty. He took me under his wing, and we worked with three of his graduate students. I got a personalized introduction to qualitative educational methods from one of the country's best. I started to get hooked. At the same time, I was added to a multi-campus committee as part of a very large retention grant. Our committee was responsible for first-year seminars modeled after the successes at the University of South Carolina. As a naïve assistant professor, when we formed the committee, it needed a chair. I said, sure, I'd be willing to be chair and was nominated and confirmed at that first meeting. Three of the full professors who were on the committee pulled me aside at our next meeting and said that if I was going to do this as an assistant professor, I needed to get some papers out of it and to ask for a graduate student to help with assessment. It was granted and we hired one of the best students I have ever worked with, Brian French, now a distinguished professor in educational psychology. That work got me into psychometrics, and we created an academic motivation instrument and measured the impact of the first-year seminars. While learning these skills, I was taking a leadership role in the emerging EPICS Program especially in the area of expanding EPICS to other institutions. EPICS offered opportunities for more research as well as means to apply what we were learning. The work we did in early scholarship helped lay the foundation to create our school of Engineering Education.

When I made the transition, there were no formal engineering education departments or schools. The engineering education community was a collection of colleagues who were mostly isolated. I got involved in ASEE and the ERM division and with the Frontiers in Education (FIE) Conference. These were the places where the community came together. In those early years, there were many people who were researchers and innovators in education. The ERM division is named for Educational Research and Educational Methods and there were both in the community. I gravitated to the M – methods people. I think this was because I saw how the current research showed conclusively that many innovations did work and could address many of the needs we had. Early in my career I became involved in service-learning and the dissemination of the pedagogy through faculty development. I saw the research as a

means to validate these approaches. That early community was very, very supportive and collaborative.

While my identity was not primarily as a researcher, my CV was one of the examples used to convince our administration to create the first department of engineering education. In those early years, we talked a lot about what we would be and how we would measure success. I advocated that we use a broad view of scholarship and be different than the traditional disciplines. The counter argument was that if we were different, we would not get academic respect and credibility. Engineering Education Research has established a global identity and credibility but have become mostly restricted to traditional views of scholarship measures in journal papers.

For me, the transition was to teach and engage with communities and other faculty. When I made that career change, the research followed. As I described earlier, I was blessed with early opportunities to gain experience qualitative and quantitative research methods that directly impacted what we were doing. I have found engineering education research with direct connection to what we are teaching and how we are engaging invaluable to improving and refining our approaches.

The current work is focused on the areas of community-engaged learning in how students learn, how we impact communities and how we assist other faculty implementing the pedagogy in their own institutions. We mostly use qualitative approaches, but we continue to use mixed methods too with significant quantitative components. Our field has focused on establishing credibility with other education, social science, and science researchers. As we mature as a field we have opportunities to connect with the engineering fields addressing important challenges to increase learning, engagement, persistence, and diversity in engineering. We also have opportunities to move findings into practice. We can reach out and re-establish connections with colleagues in the traditional engineering disciplines to work together to integrate research findings into the classrooms of the future.

## V. DISCUSSION

In analyzing our narratives, it became apparent that despite the individualities in our stories, there are several recurring themes, or points of convergence, that emerged prominently. These encompass the unexpected discovery of our passions, the non-linear pathways undertaken, varying degrees of support and resistance, the forging of multifaceted identities, and a relentless spirit of perseverance (Beddoes, 2014; Borrego & Bernhard, 2011).

All of us were propelled by persistent inquiries that eventually morphed into our core passions. The terminology used in narrating our journeys often mirrored the fortuitous and somewhat unplanned nature of our explorations into the realm of engineering education research. Our stories echo a sense of

non-linearity, lacking a predetermined roadmap, instead exhibiting comfort with a winding, undefined trajectory. There was a pronounced element of instinctiveness and spontaneity in our journeys, evoking an imagery of intuitively crafting a unique bouquet while ambling through a meadow. It is clear that our paths were characterized by purposeful intent, coalescing naturally through our individual actions and narrative constructions, echoing an appreciation for diversified perspectives gleaned through cross-disciplinary engagements (Adams et al., 2007).

A ubiquitous sentiment across our narratives was the necessity of navigating through a myriad of support systems. Interactions with diverse individuals and communities emerged as a foundational scaffold shaping our careers, albeit accompanied by instances of disagreement, disregard, and even hostility towards our endeavors. This landscape birthed a dynamic identity, sometimes taking on the role of a pioneering engineering education researcher, at other instances leveraging a cross-disciplinary approach, and occasionally reverting to our original engineering roots. This narrative reflects a rich tapestry of identities interwoven as engineers, educators, and engineering educators, underscoring the importance of harmonizing these varied identities and fluidly transitioning among them in varied contexts (Borrego & Streveler, 2014).

Reflecting retrospectively on our experiences reveals an inherent thread of tenacity running through our stories. Unpacking this further, we noticed that we constantly embraced either a “learner’s stance” or a “researcher’s stance”, fostering a readiness to step into uncharted territories and relinquish our comfort zones. This approach has not only honed our observational and synthesizing skills to a level unanticipated but also rejuvenated our commitment to lifelong learning, invigorating our professional identities through enriched experiences and learnings.

## VI. LESSONS

As we reflect on our journeys, we distill several pieces of advice that might steer the paths of emerging engineering education researchers. While these suggestions are rooted in personal experiences, they encompass universal values and strategies that could be beneficial for anyone stepping into this arena. Below are the distilled pieces of advice:

### A. Cherish and Chase Your Dreams

Delving deep into the wells of our aspirations, we find the invigorating spirit of dreams, a vital aspect that could be transformative, especially for budding engineering education researchers. The mantra "Because dreams need doing," has echoed powerfully, resonating deeply with the youthful hearts and energetic minds embarking on a path of discovery (Baranowski & Delorey, 2007). Encouraging a culture that cherishes dreams could be a potent driver, propelling individuals to break through boundaries and foster innovation. It nurtures a vibrant dynamism where dreams are not mere

figments of imagination but catalysts for real-world change. Through the pursuit of dreams, one can cultivate resilience and ingenuity, both of which are cornerstone qualities in the field of engineering.

### B. Cultivate Community Connections

In a world replete with opportunities for global collaboration, fostering community connections stands as a pillar in the progressive growth of any individual in the educational sphere. Building networks beyond one's immediate surroundings can open up rich avenues for learning and mutual growth. It is not just about expanding your social network but creating a synergistic ecosystem where diverse perspectives coalesce, offering a rich tapestry of insights and experiences. This proactive approach could be a springboard for international collaborations, further elevating the scope and impact of engineering education research.

### C. Engage Deeply with Your Field

The landscape of engineering education research is vast and constantly evolving. A deep and immersive engagement with this dynamic field requires a receptive mindset, one willing to adapt and grow with the evolving paradigms. While the journey may initially appear daunting, with continuous effort and a spirit of inquiry, one can traverse this landscape proficiently. Engaging deeply fosters a symbiotic relationship with the field, allowing one to draw from a well of knowledge while also contributing significantly to its expansion.

### D. Embrace the Learner's Perspective

To nurture a rich and fruitful educational ecosystem, adopting a learner's perspective is indispensable. It encourages a state of perpetual curiosity, where the desire to explore and learn is not confined to the students but is a fundamental principle guiding the educator's approach. This perspective beckons one to venture into unknown realms with an open heart, fostering a conducive environment for exploration and discovery where finding solutions becomes a collaborative and enriching journey rather than a solitary task.

### E. Shape Your Own Career Path

Embarking on a self-directed journey of career development heralds a path of self-discovery and purposeful growth. It encourages individuals to be vigilant, seizing opportunities that resonate with their personal and professional aspirations. This path is characterized by a dual approach, where one seeks to foster internal growth through self-improvement and external fulfillment by enhancing the learning outcomes in students. By carving out a personalized career trajectory, one stands to create a fulfilling journey marked by milestones of personal achievement and broader educational impact.

### F. Adopt a Researcher's Perspective

Adopting a researcher's perspective infuses one's educational journey with a critical lens, transforming persistent curiosities into research-driven queries with real-world implications. Envision your educational spaces – be it a class or

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an entire campus – as fertile grounds for research, constantly offering questions begging for deeper exploration. This perspective nurtures a culture of inquisitive thinking, fostering a rich dialog between one’s experiences and the evolving questions that shape the educational landscape.

It is imperative to note that these pieces of advice function as heuristics, implying that while they are grounded in reason, their efficacy is not absolute. However, drawing from Billy Koen’s articulation of the engineering method (Koen, 2003)–utilizing heuristics to optimize outcomes in complex, relatively undefined scenarios within available resources – these suggestions represent our best current strategies. We aspire that our contemplative exercise aids in enriching the existing corpus of knowledge in this domain.

## VII. CONCLUSION

In the discourse surrounding various professions, Robin Adams noted a conspicuous absence, articulated by a PhD student, of “engineering lore” in comparison to the rich narratives enveloping artists, writers, and individuals in other professions (Adams et al., 2007). This observation extends to the relatively uncharted territory of engineering education researcher lore, where the landscape of personal and professional narratives remains significantly unexplored.

In this exposition, we ventured to fill this gap to a certain extent, weaving tales from our individual journeys with the hope that they echo with others in our community. We envision these stories as potential linchpins, binding us together through shared experiences and familiar struggles, offering a glimpse into the rich tapestry that encapsulates the essence of being an engineering education researcher. We believe that these narratives can stand as a testament to our professional engagement in the field, illustrating the varied pathways and rich experiences that bring one into this sphere.

Stories, beyond being mere recounting of events, serve as discursive instruments, fostering exploration, sharing, and reflection. They are platforms that foster communal understanding, allowing for the cultivation of common grounds regarding the identity and evolution of engineering education researchers. This tapestry of tales serves as a nurturing ground where more stories can take root, facilitating transformative shifts and providing insight into the largely untread paths of this profession.

Through the lens of storytelling, the obscured becomes apparent, unveiling the underlying intentions in our deeds and shedding light on invaluable life learnings. It metamorphoses into a pedagogical tool, a mirror for reflective practice, and a wellspring for research inquiry. A well-articulated story has the power to reach out and touch others, sparking recognition, understanding, and empathy.

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As we delve into crafting our narratives, it is essential to be mindful of the core elements that make a story resonate deeply with its audience. Drawing on resources from Stephen Denning (Denning, 2004, 2005), it is emphasized that a compelling narrative encapsulates essential details about the situations and the personas involved. It weaves a coherent narrative thread, encompassing plots with their respective resolutions, thereby immersing the reader into the lived experiences of the storyteller.

We extend an invitation to you to reflect and embark on the journey of narrating your story, utilizing this rich array of tools and insights to carve out a narrative that is uniquely yours yet resonates universally, contributing to the vibrant mosaic of engineering education research lore.

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