



## Developing a Model of Professional Agency Towards Change in Engineering Education for Early Career Scholars

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Courtney is a Research Assistant Professor and Lecturer in the Cook Grand Challenge Engineering Honors Program at the University of Tennessee. She completed her Ph.D. in Engineering & Science Education at Clemson University. Prior to her Ph.D. work, she received her B.S. in Bioengineering at Clemson University and her M.S. in Biomedical Engineering at Cornell University. Courtney's research interests include epistemic cognition in the context of problem solving, and researcher identity.

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### Dr. Alexandra Coso Strong, Florida International University

As an assistant professor of engineering education at Florida International University, Dr. Alexandra Coso Strong works and teaches at the intersection of engineering education, faculty development, and complex systems design. Alexandra completed her doctorate in aerospace engineering at Georgia Tech in Spring 2014. Prior to attending Georgia Tech, Alexandra received a bachelor's degree in aerospace engineering from MIT (2007) and a master's degree in systems engineering from the University of Virginia (2010). Alexandra comes to FIU after completing a postdoctoral fellowship at Georgia Tech's Center for the Enhancement of Teaching and Learning (CETL) and three years as a faculty member at Olin College of Engineering in Massachusetts. Alexandra's research aims to improve the design of educational experiences for students by critically examining the work and learning environments of practitioners. Specifically, she focuses on (1) how to design and change educational and work systems through studies of practicing engineers and educators and (2) how to help students transition into, through and out of educational and work systems.

### Dr. Cheryl A Bodnar, Rowan University

Dr. Bodnar is an Associate Professor in the Experiential Engineering Education Department at Rowan University. Her research interests relate to the incorporation of active learning techniques such as game-based learning in undergraduate classes as well as integration of innovation and entrepreneurship into the engineering curriculum. In particular, she is interested in the impact that these tools can have on student perception of the classroom environment, motivation and learning outcomes. She was selected to participate in the National Academy of Engineering (NAE) Frontiers of Engineering Education Symposium in 2013, awarded the American Society for Engineering Education Educational Research Methods Faculty Apprentice Award in 2014 and the Raymond W. Fahien Award for Outstanding Teaching Effectiveness and Educational Scholarship presented by American Society for Engineering Education (ASEE) Chemical Engineering Division in 2017.

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Courtney S. Smith, PhD is a Undergraduate Coordinator & Teaching Assistant Professor at UNC Charlotte. Her research interests span the mentoring experiences of African American women in engineering, minority recruitment and retention, and best practices for diversity and inclusion in the Engineering classroom.

### Dr. Erin McCave, University of Houston



Erin is an Instructional Assistant Professor in the Cullen College of Engineering at the University of Houston. She joined the University of Houston after completing a postdoctoral/lecturer position split between the General Engineering program and the Engineering & Science Education Department and a Ph.D. in Bioengineering from Clemson University. Erin's research interests include preparing students for their sophomore year, minority student engineering identity development, and providing mentoring relationships to help foster student growth and success.

## **Collaborative Research: Developing a Conceptual Model of Professional Agency Towards Change in Engineering Education**

### **Executive Summary**

The purpose of this executive summary is to detail some of the methods used to develop a conceptual model of professional agency towards change in engineering education. This work was completed as part of a project funded by the National Science Foundation (NSF) titled, *Collaborative Research: Supporting Agency Among Early Career Engineering Education Faculty in Diverse Institutional Contexts*. In particular, the project focuses on exploring the experiences of six early career engineering education faculty as they attempt to impact the engineering education experiences of students locally and more broadly. The overarching question guiding this project is: *How do institutional, individual, and disciplinary field and societal features influence early career engineering education faculty's agency to impact engineering education in their particular positions?* To address this question across our different contexts, we developed a research design that implemented collaborative inquiry and collaborative autoethnography methods to examine each member of the research teams' own experiences over a period of three years.

Due to the complexity of the phenomenon, more common approaches to qualitative research (e.g., interviews, surveys, etc.) were unlikely to illuminate the manifestation of agency, which requires capturing the nuances associated with one's day-to-day experiences. Thus, we integrated collaborative inquiry and collaborative autoethnography as a means for building our model. Autoethnography is a research approach that critically examines personal experience to explore a cultural phenomenon. When multiple researchers collectively examine their personal experiences, the approach becomes collaborative autoethnography. Collaborative inquiry, in contrast to collaborative autoethnography, is a research approach where people pair reflection on practice with action through multiple cycles of reflection, collective sense-making, and action. The combination of these methodologies allowed us to deeply and systematically explore our own experiences, allowing us to develop a model of professional agency towards change in engineering education through collaborative sense-making. Throughout this process, data collection included (1) written reflections, (2) weekly meetings, and (3) framework activities. Previous works have described the design and analysis of the written reflections [1], [2] and the weekly meetings [3]. The rest of this paper will focus on the framework activities.

### **Framework Activities**

Framework activities refer to the theory-driven activities beyond our normal written reflections and weekly meetings. We used these activities to deeply, explore specific aspects of our experiences that were not adequately captured through the reflections and meetings. These activities included: our perceptions of impact and our impact specifically, social capital, and the role of current events on our practice and experiences. We identified the areas that needed further exploration through a review of Campbell and O'Meara's faculty agency framework [4]. The structure of each framework activity varied according to the nature of the construct or phenomenon of focus, and often relied on our group leveraging existing literature or the expertise of other researchers. Table 1 provides a description of the seven framework activities we completed. We completed each of the above activities intermittently over the course of six semesters.

Table 1: Summary of Framework Activities.

Activity	Description
Identity	<p>The purpose of this activity was to characterize our identities as faculty members and explore how these identities evolved over the first four semesters of our positions. We operationalized identity as the perception of one's self in a specific context. Two members of our research team read and analyzed the pre-semester, monthly, and post-semester reflections to develop written memos that describe how each of us came to see ourselves as faculty members. Interviews were conducted with each member of the group to refine the memos and probe more deeply into specific aspects of our identity development.</p>
Transition Theory	<p>The purpose of this activity was to examine our transitions into our new faculty positions over our first two years, using Schlossberg's Transition Theory [5] to create a timeline representing the critical incidents and strategies employed during each of our transitions. Four members of our research team initially analyzed our responses to two questions that we answered in our monthly reflections and used that analysis to develop timelines representing critical incidents of our transitions. Two members of the research team delved further into timeline analysis by identifying the situation, self, supports, and strategies pertaining to each identified critical incident, as defined in the Transition Theory framework [5]. Each person was involved in the development of their own timeline. This activity is further discussed in [6].</p>
Current Events	<p>The purpose of this activity was to capture the general context in which we were becoming faculty members. As a group, we constructed a list of key incidents and influences that occurred within the engineering education field, as well as any related engineering disciplinary fields, and in our local, national, and global communities from Fall 2015 to 2018. Once the list was complete, we individually added comments to capture if and how they influenced us on an individual level.</p>
Societal and Network Capital	<p>The purpose of this activity was to examine the professional networks (locally and nationally) of each research team member, and the extent to which these networks were available, accessible, and activated in our positions.</p>
Professional Impact	<p>The purpose of this activity was to establish a shared definition of impact and subsequently document the impact we had during the first five semesters of our positions. We operationalized impact using London's [7] framework to capture our scientific, societal, and contextual impact. As individuals, we completed reflections describing the impact we had, the areas we wanted to impact, and the strategic or intentional actions we planned to take to accomplish our goals. We subsequently discussed how our proposed impacts evolved based on our experiences.</p>
Reflexivity	<p>The purpose of this activity was to expand our understanding of the interplay between agency, structure, and culture. To do so, we completed an activity grounded in Archer's [8] operationalization of reflexivity, which are the conversations that people have with themselves to consider themselves in relation to their social context and vice versa. To guide our discussions and help us better understand each other, we each completed the Internal Conversation Indicator (ICONI) questionnaire [9] and discussed themes related to our modes of reflexivity.</p>

**Future Work**

We are using the results from these activities to develop a model of professional agency towards change in engineering education. Due to the longitudinal nature of this study, model development was a continual process, progressing from experience-near constructs (i.e., constructs that participants naturally use to define their experiences) to more experience-distant constructs (i.e., constructs that researchers use to forward their scientific contributions) [10]. Framework activities were one method used to facilitate this back-and-forth process, providing a space for us to reflect on our personal experiences and engage with the literature. To finalize the model, we will integrate the insights from the framework activities with those from the written reflections and weekly meetings. This process will be completed before the poster is presented. The results of this project will (1) advance the engineering education community's understanding of existing structures for facilitating change in engineering education; (2) identify barriers and supports for making change as early career engineering education faculty; and (3) develop a co-constructed understanding of how to better prepare and support faculty to exercise agency towards impacting engineering education.

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