Which ”Me” am I Today? The Many Disciplines and Skill Sets of Engineering Educators

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Pick up any issue of the Chronicle of Higher Education and it is clear that American education today, regardless of level or discipline, exists in a climate of increased scrutiny and accountability. Beyond the strong research indicating that regular assessment of classroom activities has a positive impact on student learning [e.g. 1, 2], education in the engineering disciplines today means that every faculty member must assess their own classroom if for no other reason than preparation for the next ABET accreditation cycle [3]. In addition, federal research grant-making agencies, such as the National Science Foundation, are raising the assessment requirements placed on their funded investigators in response to increased scrutiny placed on these agencies.

This shift is particularly impactful for early career faculty. As part of the shifting expectations, in classrooms and as part of research grants, engineering educators and researchers are asked to perform "small scale, local, [and] grounded" studies on the education, research, and outreach activities that they also directly or indirectly deliver [4]. Regardless of appointment or research discipline, early career faculty are also navigating shifting cultures of faculty evaluation both nationally and, likely, at their own institutions [5]. Faculty who participate in the scholarship of teaching and learning, as well as those who conduct discipline-based education research, often also find themselves at the crossroads of two or more academic disciplines. An organizing schema is needed to help researchers and educators understand the function of assessment and evaluation across the multiple professional roles and disciplines they inhabit in the academy, and to help them navigate cycles of continuous improvement. The next section discusses a new model of core roles in any discipline and how the disciplines often intersect. The following section draws in an established model of faculty skill sets to open a dialogue on how best to support faculty throughout these career steps. Finally, this paper suggests two pillars around which that dialogue can be formed: implications for faculty themselves and implications for their leaders and mentors, including impacts on policy and procedure.

Three "Hat" Model

Every discipline has three distinct but general roles, or 'hats' that individuals may wear, as seen in Figure 1: practitioner, researcher, and trainer. Practitioners are defined as those doing the day-to-day work of the discipline in field. Researchers are those who design, build, test, and validate the theories, tools, and standards used by the practitioners. Trainers are the educators, whether at colleges and universities or through professional development opportunities, who instruct and/or mentor the current practitioners as well as those individuals who would like to enter the ranks of the practitioners. It is possible for a single individual to hold one, two, or all three of these roles, such as a university professor who teaches, conducts research, and consults in the same engineering discipline.

Figure 1. Conceptual Model for the Engineering Disciplines

As Engineering Education has been specifically defined and labeled as a discipline [e.g. 6, 7], it is reasonable to apply the general conceptual model to this special case. Therefore, in the discipline of Engineering Education:

- Practitioners are classroom instructors, many of whom are also researchers in another engineering discipline. High level practitioners seek to effectively incorporate teaching and learning initiatives supported by the literature of the Engineering Education discipline.
- Researchers are scholars conducting rigorous, scientific studies in response to engineering education questions and submitting the questions, methods, and results to peer review [8].
- Trainers are the engineering education faculty, leaders and facilitators of professional development opportunities, and peer mentors who help practitioners improve teaching and learning [9].

Again, it is possible for a single individual to hold one, two, or all three of these roles.

Often, a single individual holds one or multiple roles in the Engineering Education discipline while holding one or multiple roles in an additional discipline. A frequent example of this intersection of disciplines is the faculty member who is teaching classes in one discipline, such as civil engineering, who is also using the knowledge base and outputs of researchers in the engineering education discipline. As shown in Figure 2, this individual is simultaneously 'wearing' the trainer hat for civil engineering and the practitioner hat for engineering education.

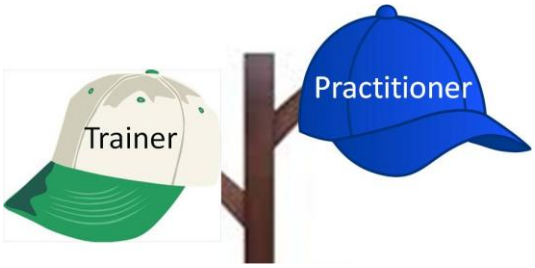

Figure 2. Intersection of Disciplines Example: Instructor

Similarly, an interdisciplinary researcher is, by definition, wearing the researcher hats of at least two disciplines, as shown in Figure 3. Recognizing that many of the activities faculty complete require at least one role in more than one discipline informs the dialogue on how we support individual faculty as well as change processes [10]. Similarly, the interdisciplinary researcher is working within the languages and norms of both disciplines. If not intentionally addressed, variations in terms describing methodologies or other components of the research process may harm the validity of assessing the research or the researcher themselves. For example, a mixed-methods researcher may find their qualitative-oriented colleagues using 'scrubbed data' to refer to removing identifiable details prior to publication while their quantitative-oriented colleagues use the same phrase to describe a practice of research misconduct. Navigating these differences in founding axioms [10] is an important area of mentoring.

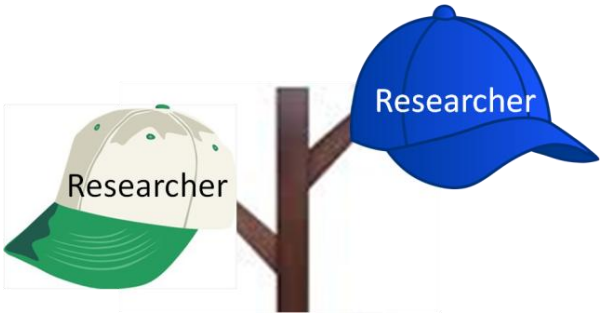

Figure 3. Intersection of Disciplines Example: Interdisciplinary Researcher

Roles, Skill Sets, and Professional Development: The Juncture of Two Models

The Three Hat Model illustrates how faculty at all stages can benefit from a team of perspectives [11], particularly across the relevant disciplines. However, most faculty receive mentoring primarily suited to only one of their multiple hats. Given their limited resources, this is also a concern for formal faculty development programs. In this section, we will show how the primary skill sets from Arreola et al.'s "Meta-Profession" project [12] are orthogonal to and illustrate some of the available sources of faculty mentoring and faculty development programs across the multiple hats faculty wear. Part of our choice of the Meta-Profession project is rooted in its origins: the concept grew out of the need to define the role of teaching in a comprehensive faculty evaluation program [13]. As such, the skills sets described below are formed for use as mentoring/development prompts, a part of faculty evaluation, and a means to supporting the evaluation and assessment of the academy.

Arreola, Theall, and their team studied the work of university faculty as well as the productivity and expectations models within which the faculty work. From this, they derived two distinct and necessary sets of professorial skills: the *base profession* skills and the *meta-professional* skills. While both sets of skills are necessary for quality faculty, neither set is individually sufficient. Base profession skills are directly related to the specific content area of practice and/or scholarship for which the faculty member has been hired. In the hiring process, an individual's

degree, transcripts, and graduate advisor are often used as proxies to ensure an acceptable minimum has been met. Base profession skills include [12]:

- Content expertise
- Techniques for keeping current in the field
- Practice and/or clinical skills appropriate to the field
- Research skills and techniques appropriate to the field

Given the interdependence between developing base profession skills and depth of knowledge of, and connection to, one's field, mentors and the knowledge base in this area are usually found in one's home department or through field-dedicated professional organizations. While much of the base profession skill work occurs within the hats of the discipline in which a faculty member is hired, interdisciplinary faculty are already wearing the hats of at least two fields.

Meta-professional skills, on the other hand, are those necessary for the cross-cutting aspects of the faculty roles of teaching and advising; scholarship and research activities; service to the profession, institution, and community; and administration and leadership. Even in the places where it may seem that a faculty member is wearing only one hat or only the hats of one field, each of these roles requires different, though overlapping, subsets of the overall meta-professional skills. Each individual's career trajectory will determine the relative level of emphasis needed in developing each skill. Meta-professional skills include [14]:

- Instructional design
- Instructional delivery
- Instructional assessment
- Course management
- Instructional research techniques
- Psychometrics and Statistics
- Epistemology
- Learning Theory
- Human Development
- Information Technology
- Technical Writing
- Graphic Design
- Public Speaking
- Communication Styles
- Conflict Management
- Group Process
- Resource Management
- Personnel Supervision and Management
- Financial and Budgetary Analysis and Development
- Policy Analysis and Development

Each of these meta-professional skills is also a content area of its own, with scholarship and networks of professionals available to aid in faculty development. From the perspective of the three hats model, the meta-professional skills represent areas where the faculty member is frequently wearing the practioner hat of one or more other disciplines. To succeed as the focus on accountability in higher education continues to increase requires faculty to further hone these meta-professional skills.

Adding Form to the Dialogue: Implications for Implementation

While considering the breadth and depth of the faculty skill set is not new [see for example 15, 16], placing the Three Hats Model and the Meta-Professional Skills Model orthogonal to one another provides an opportunity to add a "wireframe" form to the on-going dialogue. In particular, we consider the implications to the faculty and those who lead and mentor faculty, including the impact on organizational policy and procedure. Faculty, their mentors, and

development professionals can use the intersection of the Three Hats Model and the meta-professional skills project to broaden the basis of training topics and wellsprings of potential expertise. These frameworks support both the career and learning trajectory of individual faculty and changes necessitated by increased assessment and evaluation in higher education.

Sample Implications for Faculty

For faculty, recognizing that they are wearing multiple hats gives a name to the tension between the skills in which they have training and the additional skills they are still expected to know, a socialization process that begins even before completing graduate school [17]. Naming both the tension and the goals is particularly important for faculty to create their own successful learning trajectory given that whether the outcome of the change is known, and can be described, in advance is a key factor for achieve change [18]. Similarly, this provides faculty a window into how the context of their career, including the type of institution, productivity expectations, and available resources, can result in different artifacts on their CV [19, 20].

Further, as faculty determine the nuances of their career goals, the juncture of the Three Hats Model and the Meta-Professional Skills can help them design a development roadmap that is sufficiently broad to provide the foundation skills necessary while also pointing to disciplines that may supplement the faculty member's current skill set and/or suggest potential mentors or training opportunities in other disciplines.

Sample Implications for Faculty Leaders and Mentors

Faculty leaders and mentors have significant roles both at the person level, mentoring and supporting the development of individual faculty, and at the organizational level, influencing and/or implementing the policies and procedures of the organization that form one set of constraints to the faculty career. As we think about the best ways to mentor junior faculty in particular, how can we design mentoring plans that provide space and encouragement to hone both base and meta-professional skills, while also mentoring across multiple hats in multiple disciplines? The traditional best practice of assigning a single senior faculty member in the department will in most cases be insufficient support to today's faculty member. At the same time, assigning multiple mentors can result in conflicting advice and large investments of time that may compete with other priorities for junior faculty. There is a parallel set of questions when we turn our gaze to helping faculty develop and navigate their professional networks [21].

At the organizational level, one of the artifacts of the institution that has the most salience to faculty is the tenure and promotion process. Faculty leaders and mentors bridge the person and organization levels through guiding their colleagues in preparation for these evaluation activities. How faculty tell their story matters for effective integration into the tenure and promotion processes [22]; the combination of the Three Hats and Meta-Professional models points to additional mechanisms for explaining to peers and administrators the importance of the diverse activities on a given CV and/or the validity of engineering education research. Similarly, faculty leaders influence the types and quantity of resources available to faculty to support their career goals. Expecting increased levels of research productivity or pedagogical expertise than the department or college has required in the past is change in the cultural model; having the right resources in the right supply is vital to successful adaptation of a new cultural model [23].

Conclusion

Recognizing the three hat model opens a dialogue for early career faculty regarding the many professional roles they play every day. Placing the meta-professional skills model orthogonal to the three hats adds nuance through illustrating the many fields that must interconnect to support the faculty learning curve. Bringing these two models together informs the ongoing discussion on how to best holistically support faculty in our changing environment and across multiple levels of the organization [18].

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