THE OHIO STATE UNIVERSITY

COLLEGE OF ENGINEERING

Preparing Future STEM Faculty to Become Stewards of Their Disciplines

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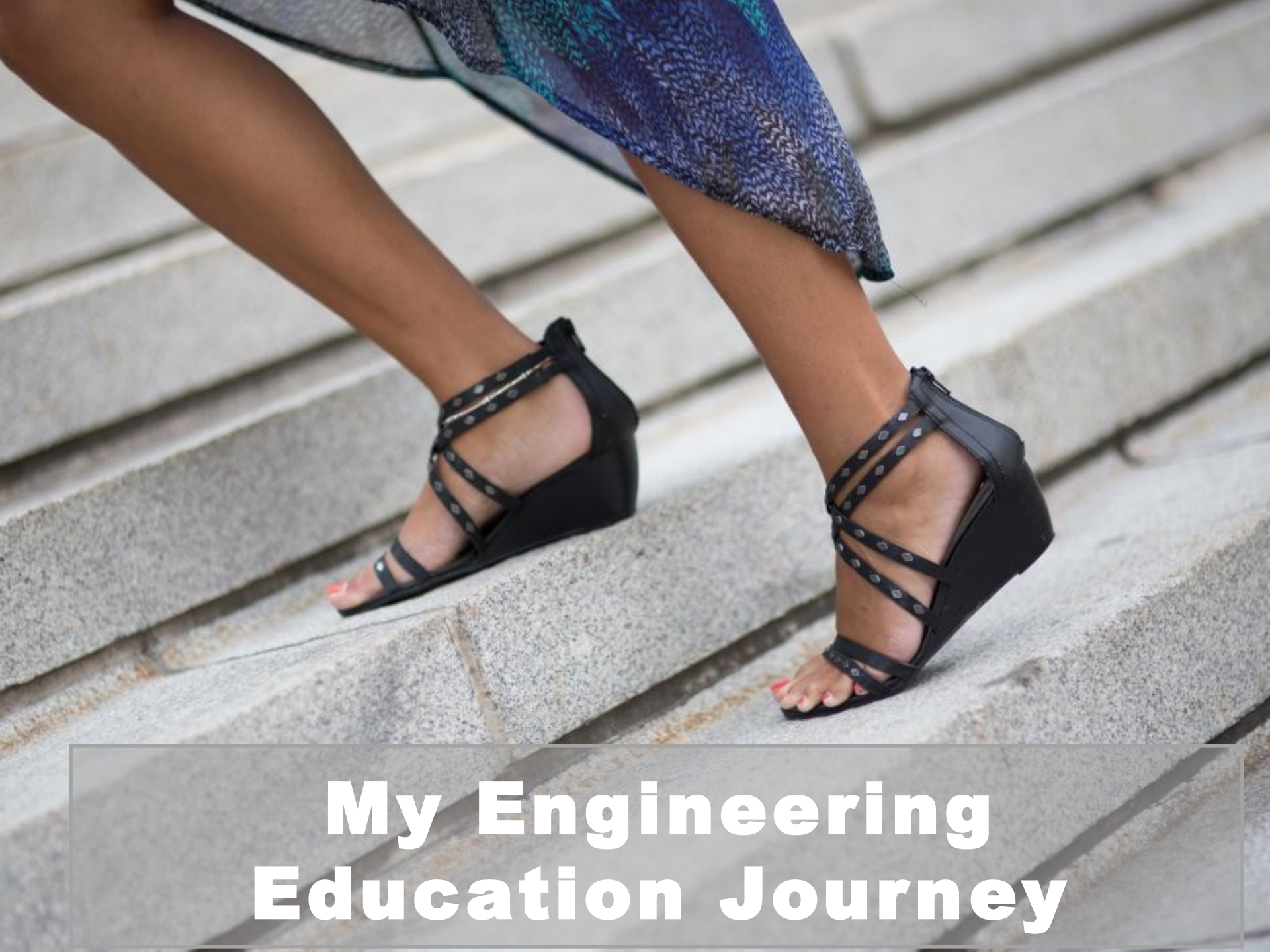

My Engineering Education Journey


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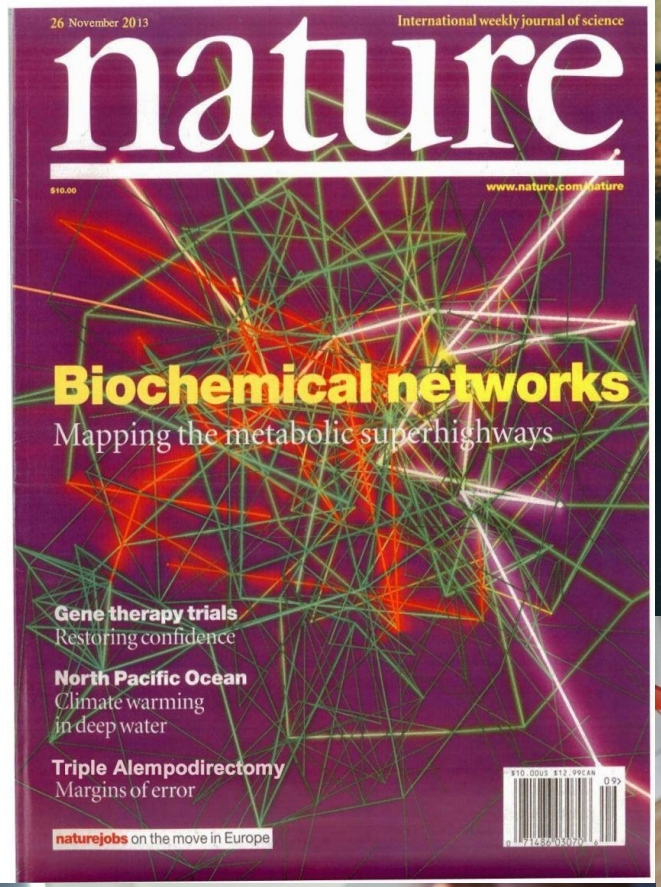


Photos by Tim Guow, Jeff Sheldon, rawpixel.com on Unsplash

Photos by Zac Nielsen on Unsplash; GoldieBlox, CBS, & Comedy Central

Big Questions

- How do you engage new audiences in Boyer's scholarship (i.e., discovery, integration, application, and teaching and learning) across faculty types?
- How do you acknowledge faculty who expand traditional boundaries?
- How do you encourage faculty to transcend their disciplinary perspectives?
- What does "high impact" mean for tenure-track AND non tenure-track faculty?
- How do we transform engineering so that engineers are at the forefront of politics, entertainment, athletics, business, and any area that impacts life as we know it?

Fail Fast

Think Out of the Box

Encourage and Reward Innovation

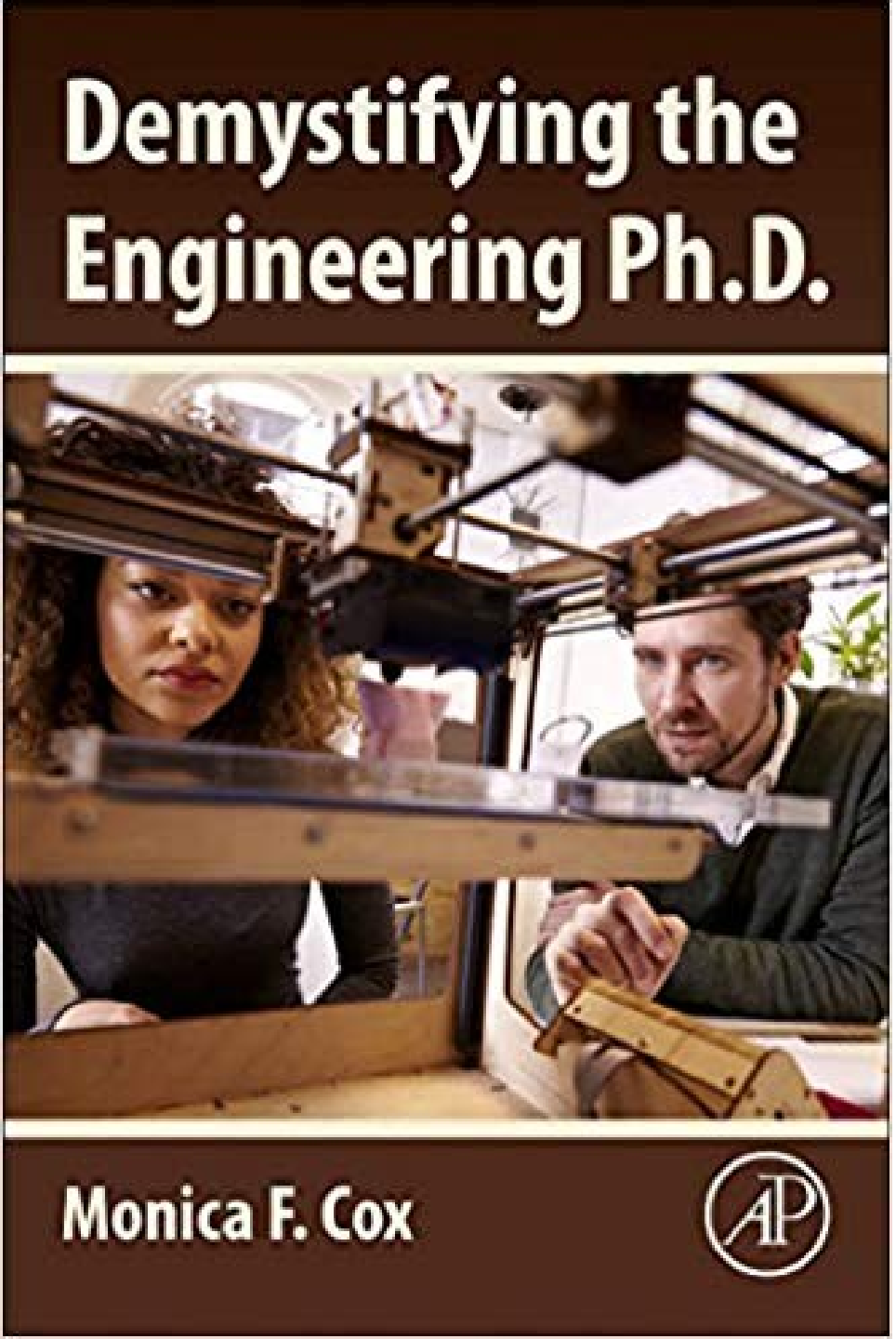
Promote Teamwork

Acknowledge Personalization of the Faculty Experience

NSF CAREER Study

- 40 engineering Ph.D. holders in academia and industry
- **Stewardship Framework** (Golde & Walker, 2006)
  - Generation, Conservation, Transformation
- **Characteristics** (transcends workplace)
  - Curiosity, adaptability, ethical awareness
- **Expectations** (workplace)
  - Leadership skills, understanding of technical work
- **Recommendations**
  - Interdisciplinary projects , communication skills, proposal writing, running research lab, managing projects and budgets

- **Presidential Early Career Award for Scientists and Engineers (PECASE), January 2010**
- ***Demystifying the Engineering Ph.D.*** **(Elsevier) 2019**



Available November 2019

Generation

Generating new knowledge and defending knowledge claims against challenges and criticism

Research	Contributions to the Field	Characteristics	Knowing the Field
• Improve on prior knowledge or processes • Employ rigorous research methods • Problem analysis • Data analysis	• **Vision** • **Impact** • Publications, presentations, and patents	• Personal characteristics • Professional characteristics • Ability to teach others general knowledge	• Knowing the field

Berdanier, C.G.P., Tally, A., Branch, S.E., Ahn, B., & Cox, M.F. (2016) A strategic blueprint for the alignment of doctoral competencies with disciplinary expectations. *International Journal of Engineering Education*, *32*, 1759–1773.

Generation

- Involve oneself with collaborative inter- or multidisciplinary research
- Assist on projects that will be commercialized or patented
- Seize opportunities to work closely with an industry-sponsored research project
- If possible, intern at organizations that align with career goals: Industry, start-up companies, national laboratories, private R&D firms, or conduct research at collaborating institutions
- Develop relationships with people who have complementary research skills in order to develop the potential for future collaborations
- Reflect on how dissertation research fits into the larger field, and how one's specific research skills will be valuable to various employment sectors

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Conservation

Conserving the most important ideas and findings that are a legacy of past and current work

Technical Skills (general)	Technical Leadership	Knowing the Field
• Mathematical fundamentals • Engineering fundamentals • Expertise • Scientific method • Data analysis • Technology	• Teaching • **Assessing relevance in the field**	• Employ literature • **Identify current technology and trends** • Synthesize existing information • Use multiple resources from diverse sources

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Conservation

- Help to review or critique manuscripts for conference or journal under the guidance of a mentor
- Serve as a session moderator at a conference
- Attend disciplinary conferences
- Teach fundamental engineering courses to novice engineers
- Attend seminars, dissertation defenses, and other presentations in one's own discipline and related disciplines
- Visit relevant start-up companies to understand future commercialization opportunities
- Actively discuss future grant or funding opportunities with advisors, funding agency representatives, and industry sponsors affiliated with one's discipline

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Transformation

Transforming knowledge that has been generated and conserved by teaching well to a variety of audiences, including those *outside* formal classrooms.

Teaching	Verbal Communication Skills	Written Communication Skills	Communication (General)	Application of Knowledge
• Tailoring communication to audience • **Non-classroom teaching** • Classroom Teaching • **Mentoring** • **Administration** • Outreach	• Presentation skills • Conferences • **Concise communication** • **Communicating appropriately for situations and audiences**	• Journal publications • Patents • Concise communication • Appropriate mode of communication • Research proposals	• Personal attributes • **Break down complex ideas** • Tailor communication to audience	• **Recognize impact** • Commercialization • Patents • **Broader impacts**

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Transformation

- Present research at conferences, both within one's discipline and at interdisciplinary conferences
- Pursue teaching opportunities, recognizing that "Teaching" skills are useful within both industry and academic careers
- Apply research expertise to projects which have broad societal impact
- Practice disciplinary writing in a variety of venues: Grant writing, fellowship applications, journal/conference paper publication
- Practice disciplinary communication: Seek opportunities to present at departmental seminars; substitute teach undergraduate courses; practice appropriate communication, grammar, and spelling in all communication (including email)
- Explicitly network with leaders in the field at conferences in order to practice verbal communication about your research and interpersonal skills
- Seek advice and mentorship with disciplinary leaders outside one's institution to build strong relationships and future collaborations that span disciplines.

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Competencies Blueprint			
Desired career trajectory:			
Desired career job description:			
Knowledge, skills or attributes required to succeed in this position:			
	Goals: Conservation Competencies Know and Preserve Disciplinary Knowledge	**Goals: Generation Competencies** Produce New Knowledge that Contributes to the Field	**Goals: Transformation Competencies** Translate expertise to a variety of audiences and situations
Prior Competencies			
Semester 1			
Semester 2			
Semester 3			
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Google
KEEN
ENGINEERING UNLEASHED
Will I be evaluated fairly?
Do I belong?
Can I be my true self?
If I take a risk, will I lose my job?
How do I connect to communities that matter?

Acknowledgements

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