Catherine G.P. Berdanier
cgb9@psu.edu
Department of Mechanical Engineering
Pennsylvania State University

Academic Positions

Assistant Professor of Mechanical Engineering
Director of the Online MSME Program
Pennsylvania State University Department of Mechanical and Nuclear Engineering

Research Associate
Director of the Online MSME Program
Pennsylvania State University Department of Mechanical and Nuclear Engineering
July 2016-June 2018

Education

Ph.D., Purdue University School of Engineering Education
August 2013-May 2016
Ph.D. Dissertation: *"Learning the Language of Academic Engineering: Sociocognitive Writing in Graduate Students"*

M.S., Purdue University School of Aeronautical and Astronautical Engineering
August 2010-August 2013—Major area: Propulsion; Minor areas: Mathematics, Optics
Master's Thesis: *"Flowfield Characterization of a Piloted Lean Premixed Injector by Particle Image Velocimetry."*

B.S., University of South Dakota Department of Chemistry
August 2006-May 2010—B.S. Chemistry; B.S. Spanish; Minor: Physics
USD Senior Honors Thesis: *"Quantification of fuel emissions and boundary layer NOx formation from a two-stage-to-orbit scramjet scenario"*

Fellowships, Awards, and Honors

- 2018 American Educational Research Association (AERA) award for Outstanding Doctoral Dissertation (awarded every other year for the previous period).
- 2017 IEEE New Faculty Fellowship (IEEE Frontiers in Education Conference)
- 2016 IEEE Professional Communication (ProComm) Conference Hayhoe Award
- 2016 ASEE Graduate Studies Division Best Paper Award
- Purdue School of Engineering Education Graduate Student Research Award (2016)
- NSF Integrative Graduate Education and Research Traineeship (IGERT) Fellow (2013-2016)
- Purdue School of Engineering Education Graduate Student Service Award (2015)
- NASA Graduate Aeronautics Scholarship Program Fellow (2011-2013)
- NSF Graduate Research Fellowship Program (GRFP) Awardee (2011)

Research

Pennsylvania State University **2016-present**
Department of Mechanical Engineering

Awarded Grant Proposals:

NSF 1733594 (PI): Investigating the Formation of Engineers and the Future Professoriate: Linking Academic Writing to Doctoral Socialization, Persistence, and Attrition *(Period of performance 8/1/2017-7/31/20)*

Though doctoral engineering education is understudied as a whole, attrition in graduate engineering education is particularly unexplored. Recent reports by the Council of Graduate Schools reported that in engineering, the 10-year completion rate for doctoral programs for domestic students was only 59%. Attrition is problematic for several reasons. First, since many domestic students are funded by federal grants (through NSF, for example) and through domestic industry, each domestic student that leaves academia prematurely represents a lost investment. Second, graduate students are required for the continued quantity and quality of engineering research and development that supports all facets of engineering, impacting defense, biomedical applications, and energy technologies, and will be future thought-leaders in engineering industry and academic research. Even though engineering is usually represented solely as a mathematical and scientific discipline, being able to successfully write for an academic engineering audience can be the difference between completing a Ph.D. or leaving without a degree. However, to date, no research has studied the linkage between engineering writing, attrition/persistence and career goals for engineering graduate students. This study employs both qualitative interview techniques and statistical methods to study domestic graduate students who have decided to stay in graduate school and those that decided to leave academia.

NSF 1844878 (PI) "CAREER: Characterizing Master's-Level Departure from the Engineering Doctorate through Multiple Stakeholders' Perspectives." (Period of Performance 8/1/2019-7/31/24)

Abstract: This project addresses the critical issue of doctoral student attrition in engineering disciplines. While the ten-year completion rates for engineering PhDs are only 65% for men and 56% for women, these numbers are significantly lower for students from underrepresented groups. These statistics represent a significant loss of talent for the field. This CAREER research characterizes and models Master's-level departure from engineering PhD programs by analyzing the perspectives of departers, graduate students who are considering departure, and faculty who advise these students. This research supports national calls to action such as the 2018 National Academies report on Graduate STEM Education for the 21st Century, which posits that understanding retention in science, technology, engineering, and mathematics graduate programs is critical to maintaining economic and national competitiveness. This CAREER research will develop a comprehensive understanding of Master's-level departure with a systems-level perspective. In order to develop this model, the research will 1) characterize common narratives of Master's-level departure and model students' departure decisions over time, and 2) characterize faculty perspective of departure. Modeling student departure will be accomplished through interviews, a longitudinal survey,

and a longitudinal text message survey that utilize role identity theory, expectancy value theory, ideal worker theory, and leader-member exchange theory. The faculty-centric research phase will investigate potentially conflicting narratives about attrition and departure between departed/questioning graduate students and faculty. Understanding these potentially dissonant perspectives between faculty and students are critical to developing interventions for either stakeholder group.

Pending Grant Proposals:

NSF IUSE (Submitted October 2018, PI) "Exploring the Relationship between Implicit Bias, Engineering Design, and Engineering Ethics"

NSF IUSE (Submitted October 2018, Co-PI) "Investigating the Communication-Prototype Nexus in Engineering Design: Towards Automated Feedback via Machine Learning"

Purdue University **2013-2016**
School of Engineering Education
NSF Integrative Graduate Research Education and Traineeship (IGERT) Fellow

Purdue University **2010-2013**
School of Aeronautical and Astronautical Engineering
NASA Aeronautics Scholarship Program Fellow
NSF GRFP Awardee

NASA Glenn Research Center **2012**
NASA Graduate Aeronautics Scholarship Program Intern *Cleveland, OH*

Mentorship

Graduate Advisor

Ellen Zerbe, Ph.D., Department of Mechanical Engineering, Penn State University

Priyesh Mehta, M.S., Additive Manufacturing and Design, Penn State University

Manoj Malviya, M.S., Department of Mechanical Engineering, Penn State University

Carey Whitehair, M.S. Thesis. May 2018. *"Capturing Narratives of Graduate Engineering Attrition through Qualitative Analysis of Social Media Forums."* Department of Mechanical Engineering, Penn State University.

Undergraduate Research Assistants

Brenna Stone—College of Engineering Equity REU Fellow 2019
Colin Miller—Schreyer Honor's Scholar, Department of Mechanical Engineering (Thesis Advisor)
Emma Hocker
Tatiana Klett

Elliot Bruce
Eric Baker—Erickson Discovery Grant Awardee 2018; College of Engineering CERI Fellow 2017 and Undergraduate Researcher
Weiqin Wang –College of Engineering CERI Fellow 2018
Aldrich Jiao-- College of Engineering CERI Fellow 2018
Codi Belfield
Michael Cooper—CoE Multicampus REU Student
Sanyukta Baluni

Graduate Committee Member

Ally Ironside, M.S. 2017, Ph.D. 2020
M.S. Thesis: Civil and Environmental Engineering, Oregon State University. December 2017. *"An exploration of faculty sensemaking in the adoption of course social and cognitive engagement (CSCE) surveys."*

Joana Melo, Ph.D. anticipated Aug 2019

Slki Narae Lim, M.S. Thesis, Department of Educational Psychology, Penn State University. April 2017. *"Optimization of the lyophilization of plasma to reduce total cycle time."*

Lisa Carlin, M.S. Paper, Department of Mechanical Engineering, Penn State University. April 2017. *"Optimization of the lyophilization of plasma to reduce total cycle time."*

Teaching

Pennsylvania State University
Spring 2017, 2018, 2019 — ME 504: Advanced Engineering Thermodynamics
Fall 2016, 2017, 2018 — ME 597: Graduate Engineering Writing and Communication

Purdue University-School of Engineering Education
Spring 2015 — Faculty Apprentice for ENE 506: Theories of Engineering Thinking

Peer-Reviewed Publications

Berdanier, C.G.P., Tang, X., Cox, M. F. (2018). Ethics and sustainability in global contexts: Studying engineering student perspectives through photoelicitation. *Journal of Engineering Education, 107*(2), 238-262.

Fillenwarth, G. M., McCall, M., & **Berdanier, C.G.P.** (2018). Quantification of Engineering Disciplinary Discourse in Résumés: A Novel Genre Analysis with Teaching Implications. *IEEE Transactions on Professional Communication 61*(1), 48-64.

Berdanier, C.G.P., Tate, R.H.S., Iwinski, T., and Kulkarni, A., (2017). "Investigation of engineering student engagement and behavior in an online second-year thermal science course." *Journal of Engineering Education Transformations, 30* (3), 143-149.

Berdanier, C.G.P., Branch, S., Tally, A., Ahn, B., & Cox, M.F. (2016). Aligning engineering education with disciplinary expectations: A strategic blueprint for doctoral competency assessment. *International Journal of Engineering Education* 32*(4),* 1759–1773.

Berdanier, C. G., Zephirin, T., Cox, M. F., & Black, S. M. (2016). Teaching MSE Students to Teach: A Design-Based Research Model for Introducing Professional Skills into the Technical Curriculum. In *Professional Development and Workplace Learning: Concepts, Methodologies, Tools, and Applications* (pp. 444-470). Hershey, PA: IGI Global, Business Science Reference. doi:10.4018/978-1-4666-8632-8.ch028

Berdanier, C.G.P., Zephirin, T.K., Cox, M.F., & Black, S.M., (2015). Teaching MSE students to teach: A model for introducing professional skills into the engineering curriculum. In H. Lim (Ed.) *Recent developments in materials science and corrosion engineering education* (pp. 369-396). IGI Global: Hershey PA.

Berdanier, C.G.P. & Cox, M.F. (2015). Research and Assessment of Learning Environments through Photoelicitation: Graduate Student Perceptions of Electronics Manufacturing in India Advances in Engineering Education. *Advances in Engineering Education, 4*(4), 1-24.

Saravanakumar T. Pillai, Tom Fischer, Tyler T. Clikeman, Jennifer Esbenshade, **Catherine Berdanier**, …, James D. Hoefelmeyer. (2015). Single Site Metal Ions on the Surface of TiO_2 Nanorods—A Platform for Theoretical and Experimental Investigation. In Dimitri Kilin (Ed.) *Photoinduced Processes at Surfaces and Materials* (pp. 103-116). ACS Symposium Series, Vol. 1196. American Chemical Society. ISBN: 9780841230941. DOI: 10.1021/bk-2015-1196

Publications in Review

Berdanier, C.G.P. (in review) Genre maps as a method to visualize engineering writing and argumentation patterns. Submitted to *Journal of Engineering Education.*

McCall, M., Fillenwarth, G., and **Berdanier, C.G.P.** (in review). Engineering Résumé Writing and Professionalization: A Quantitative Approach to Facilitating Students' Professional Development. Submitted to *2018 International Writing Across the Curriculum Edited Collection.*

Handley, M. and **Berdanier, C.G.P.** (in review). Operationalizing interpersonal behaviours of leadership for early-career engineers. Submitted to *International Journal of Engineering Education.*

Berdanier, C.G.P., Fillenwarth, G., McCall, M. (in review). Capturing emerging activity: Comparing web and conventional engineering résumés through genre and activity theory. Submitted to *Journal of Business and Technical Communication.*

Berdanier, C.G.P., Whitehair, C., Kirn, A., & Satterfield, D. (in review.) Understanding the narratives of graduate engineering attrition through analysis of social media forums. Submitted to *Journal of Engineering Education.*

Berdanier, C.G.P. (in review) A mixed methods study correlated writing attitudes with enacted engineering writing patterns. Submitted to *Journal of Engineering Education.*

Peer-Reviewed Conference Papers

*Presenting Author

Berdanier, C.G.P., Baker, E., Wang, W., and McComb, C. (2018). Opportunities for Natural Language Processing in Qualitative Engineering Education Research: Two Examples. IEEE Frontiers in Education Conference. October 3-6, 2018, San Jose, CA.

Zerbe, E.* and **Berdanier, C.G.P.** (2018). Correlations between graduate student writing concepts and processes and certainty of career trajectories. IEEE Frontiers in Education Conference. October 3-6, 2018, San Jose, CA.

Menold, J., **Berdanier, C.G.P.**, McComb, C., Hocker, E., Gardner, L. (2018). "Thus, I had to go with what I had:" A multiple methods exploration of novice designers' articulation of prototyping decisions. Proceedings of the ASME International Design Engineering Technical Conferences, August 26-29, Quebec City, Quebec, Canada.

McComb, C., **Berdanier, C.G.P.**, Menold, J., Hocker, E., Gardner, L. (2018). Design practica as authentic assessments in first-year engineering design courses. ASEE First Year Engineering Education (FYEE) Conference, July 25-26, Glassboro, NJ.

Berdanier, C.G.P.* and Zerbe, E. (2018). Quantitative investigation of engineering graduate student conceptions and processes of academic writing. IEEE Professional Communication Conference (Procomm), July 22-25, 2018, Toronto Canada.

Whitehair, C. and **Berdanier, C.G.P.*** (2018). "Capturing Narratives of Graduate Engineering Attrition through Online Forum Mining" 125th ASEE Annual Conference & Exposition, Salt Lake City, UT.

Berdanier, C.G.P.* and Trellinger, N.M. (2018). "Data Visualization for Time-Resolved Real-Time Engineering Writing Processes" 125th ASEE Annual Conference & Exposition, Salt Lake City, UT.

***Berdanier, C.G.P.** and Trellinger, N. M. (2017) Development of a Method to Study Real-Time Engineering Writing Processes. IEEE Frontiers in Education Conference, Oct 18-21, 2017, Indianapolis, IN.

***Berdanier, C.G.P.,** Baluni, S., and Whitehair, C. (2017) Investigating strategies of pre-tenure women engineering faculty to overcome microaggressions in the classroom. IEEE Frontiers in Education Conference, Oct 18-21, 2017, Indianapolis, IN.

Lenart, J. and *__Berdanier, C.G.P.__ (2017) A genre analysis of graduate student literature reviews in engineering: Toward understanding patterns of disciplinary argumentation (Brief Paper). IEEE Professional Communication Conference (Procomm), July 23-25, 2017, Madison, WI.

*Whitehair, C. and __Berdanier, C.G.P.__ (2017). The role of trust in collaborative research settings: Opportunities for future research in graduate engineering education. 124th ASEE Annual Conference & Exposition, June 25-28, 2017, Columbus OH.

__Berdanier, C. G. P.,__ Tate, R.. H., Iwinski, T., *Kulkarni, A., (2017) Investigation of engineering student engagement and behavior in an online second-year thermal science course. Presented at the International Conference on Transformations in Engineering Education, January 6-12, 2017, India.

__*Berdanier, C.G.P.,__ McCall, M., & Mike, G. (2016) A degree is not enough: Promoting Engineering Identity Development and Professional Planning through the Teaching of Engineering Résumé Writing. IEEE Frontiers in Education Conference, Oct 12-15, 2016, Erie PA.

__*Berdanier, C.G.P.,__ McCall, M., & Mike, G. (2016) Résumés in the Development of Undergraduate Engineering Identity: A Genre Analysis with Teaching Implications. IEEE Professional Communication Conference (ProComm), Austin TX, Oct 3-5, 2016.

__*Berdanier, C.G.P.__ & Cox, M.F. (2016). Characterization of intellectual merit in NSF Graduate Research Fellowship Program (GRFP) applications. 123rd ASEE Annual Conference & Exposition, June 26-29, New Orleans, LA.

__Berdanier, C.G.P.__, Tanyi, E.K., Cashwell, I., Zephirin, T.K., & Cox, M.F. (2016). Learning to conduct "team science" through interdisciplinary engineering research. 123rd ASEE Annual Conference & Exposition, June 26-29, New Orleans, LA.

__*Berdanier, C.G.P.__ & Cox, M.F. (2015). Understanding missions for engineering outreach and service: How new engineering faculty can learn from past generations of Ph.D.-holding engineers and engineering educators. 122nd ASEE Annual Conference & Exposition, June 14-17, Seattle, WA.

__*Berdanier, C.G.P.,__ Wallin, T.J., Murphy, M. … Cox, M.F., (2015). Learning non-technical skills from pedagogical training: Investigating IGERT student perceptions. 121st ASEE Annual Conference & Exposition, June 14-17, Seattle, WA.

Sambamurthy, N., __Berdanier, C.G.P.,__ Cox, M.F., Lv, J., Maeda, Y., & Johari, S.M. (2015). Making meaning of data: Exploring representations of classroom activities from a first year engineering course. 121st ASEE Annual Conference & Exposition, June 14-17, Seattle, WA.

Louis, J., Osagiede, A., __Berdanier, C.G.P.,__ Cox, M.F., & Ahn, B. (2015). Engineering leadership assessment to action: Development of leadership profiles for academic success. 121st ASEE Annual Conference & Exposition, June 14-17, Seattle, WA.

__*Berdanier, C.G.P.__, Branch, S.E., London, J., Ahn, B. & Cox, M.F. (2014). Survey analysis of engineering graduate students' perceptions of the skills necessary for career success in industry and academia. 121st ASEE Annual Conference & Exposition, June 15-18, Indianapolis, IN.

Adams, R., **Berdanier, C.G.P.**, Branham, P., Choudhary, N., Fletcher, T., Goldstein, M., Joslyn, C., Mathis, C., Siverling, E., Trellinger, N.M., & Wilson, M.D. (2014). A community of practice approach to becoming an engineering education research profession. 121st ASEE Annual Conference & Exposition, June 15-18, Indianapolis, IN.

Zephirin, T.K., **Berdanier, C.G.P.**, Black, S.M., & Cox, M.F. (2014). Snapshot of an interdisciplinary graduate engineering education experience. 121st ASEE Annual Conference & Exposition, June 15-18, Indianapolis, IN.

McClurkin, J.D., Fitzpatrick, V.R., **Berdanier, C.G.P.**, & Cox, M.F. (2014). Development of industry modules for engineers pursuing advanced degrees. 121st ASEE Annual Conference & Exposition, June 15-18, Indianapolis, IN.

Cox, M.F. , Brunson, P.C., Sambamurthy, N., Branch, S., & **Berdanier, C.G.P.** (2014). Transformation of faculty dissemination practices via social media. 121st ASEE Annual Conference & Exposition, June 15-18, Indianapolis, IN.

Workshops and Invited Talks

Berdanier, C.G.P. and Luchini Colbry, K. "The care and keeping of graduate students: An interactive panel discussion for novice advisors of graduate students." 124th ASEE Annual Conference & Exposition, June 25-28, Columbus OH.

The Pennsylvania State University — February 18, 2016
The Ohio State University — February 12, 2016
The University of South Dakota, Department of Chemistry — October 9, 2015

Academic Service

- Graduate Recruitment and Support Committee; Department of Mechanical and Nuclear Engineering, Penn State (2016-present)
- Graduate Policies Committee, Department of Mechanical and Nuclear Engineering
- Reviewer for the Journal of Engineering Education
- Reviewer for American Society for Engineering Education Annual Conference
- Reviewer for the ASME International Gas Turbine Institute (IGTI) Turbomachinery Technical Conference & Exposition (Turbo Expo) (Education Committee)

Outreach

- Speaker for Multicultural Engineering Graduate Association (September 2017)
- Speaker for Research Experience for Undergraduates (April 2017)
- Purdue University Women in Engineering Program Graduate Mentoring Program (GMP) Leadership Team (2013-2016); Member of GMP (2010-2016)
- Leader of Purdue Graduate Writing Small Group (2014-2016)