CRLT-ENGIN
UNIVERSITY OF MICHIGAN

ANNOTATED BIBLIOGRAPHY

Major Publications by CRLT-Engin Staff

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CRLT-Engin appreciates your interest in the major publications by our staff. In this bibliography, we annotate 39 articles appearing in leading peer-reviewed journals in the past ten years. The articles describe both engineering education research conducted by our staff and efforts to promote the discipline of faculty professional development. We highlight the research ***method*** and ***impact*** of each work. Of the 39 articles, 12 were published in the *Journal of Engineering Education*, the top journal of the field of engineering education. These prestigious articles are marked by the journal's logo.

Articles are organized into six categories for easier review, including: understanding students, ethical development, creativity and design, instructional technology, scholarship of teaching and learning, and faculty and TA development. We are happy to discuss our work at any time. Enjoy your reading.

TABLE OF CONTENTS

UNDERSTANDING STUDENTS

- Davis, C.-S. G., & **Finelli, C. J.** (2007). Diversity and retention in engineering. In M. L. Kaplan & A. T. Miller (Eds.), *The Scholarship of Multicultural Teaching and Learning. New Directions for Teaching and Learning, 111* (pp. 63–71). San Francisco: Jossey-Bass.

  Method: Curricular and co-curricular efforts at the University of Michigan highlight opportunities for instructors to improve academic achievement and retention of underrepresented students in engineering fields.

  Impact: The twenty-first century engineer enters a global workforce with wide-ranging business and social sector expectations. Instructional improvements to prepare engineers for success include providing research opportunities, incorporating service-learning during first-year studies, and introducing real-world contexts.

- Mesa, V., Jaquette, O., & **Finelli, C. J.** (2009). Measuring the impact of an individual course on students' success. *Journal of Engineering Education, 98*(4), 349-359.

  Method: First-year engineering students who tested out of first-semester calculus were divided into two groups: those who took regular Calculus II and those who took Honors Calculus II.

  Impact: After controlling for students' prior achievements, students enrolled in Honors Calculus were not found to have higher performance than those who did not. However, regardless of Calculus II course, Advanced Placement (AP) math scores did account for higher student performance. Thus, AP scores should be included in future models of student success.

- Peters, D., & **Daly, S.** (2013). Returning to graduate school: Expectations of success, values of the degree, and managing the costs. *Journal of Engineering Education, 102*(2), 244-268.

  Method: Ten students completing graduate degrees after at least five years in industry were surveyed to identify their beliefs about their ability to succeed, their views of the values of graduate school, and the costs of returning.

  Impact: With the knowledge of the four identified costs (intellectual, balance, cultural and environmental, and financial), returning students can more effectively plan to succeed with their schooling.

ETHICAL DEVELOPMENT

- Burt, B. A., Carpenter, D. D., Holsapple, M. A., **Finelli, C. J.**, Bielby, R. M., & Harding, T. S. (2013). Out-of-classroom experiences: Bridging the disconnect between the classroom, the engineering workforce, and ethical development. *International Journal of Engineering Education, 29*(3). 714-725.

  Method: Student and faculty focus groups at 18 institutions were conducted to characterize the contribution of out-of-classroom experiences to ethical development of engineering undergraduate students.

  Impact: Data suggests that out-of-classroom experiences complement in-class instruction and improve students' ethical development. Faculty are encouraged to incorporate instruction that integrates in-class activity with out-of-classroom experiences to teach and promote open discussion regarding ethics.

- Carpenter, D. D., Harding, T. S., & **Finelli, C. J.** (2010). Using research to identify academic dishonesty deterrents among engineering undergraduates. *International Journal of Engineering Education, 26*(5), 1156-1165.

  Method: This review summarizes the authors' work on characterizing ethical behavior of engineering undergraduates. Efforts include identifying rates of cheating among engineering undergraduates, understanding motivations behind cheating, and studying links between cheating during college and unethical behavior in the workplace.

  Impact: Previous work has shown that engineering students are among the most frequent cheaters in college. Findings presented here suggest that pedagogical, psychological, and physical deterrents as practical ways to reduce incidents of cheating.

- Carpenter, D. D., Harding, T. S., **Finelli, C. J.**, Montgomery, S. M., & Passow, H. J. (2006). Engineering students' perceptions of and attitudes towards cheating. *Journal of Engineering Education, 95*(3), 181–194.

  Method: At 11 institutions, 643 engineering and pre-engineering students completed a comprehensive survey to investigate perceptions of and attitudes towards cheating.

  Impact: Descriptive data from the survey identified behaviors students perceive as cheating, the frequency with which and reasons students cheat, and possible strategies for reducing cheating.

- Carpenter, D. D., Harding, T. S., Sutkus, J., & **Finelli, C. J.** (2014). Assessing the ethical development of Civil Engineering undergraduates in support of the ASCE Body of Knowledge. *Journal of Professional Issues in Engineering Education and Practice*.

  Method: Researchers visited 19 diverse institutions and surveyed nearly 150 faculty/administrators and 4,000 engineering undergraduates about students' ethical development.

  Impact: To fulfill the ASCE Body of Knowledge outcomes for the Vision of 2025, institutions need to supplement curricular activities with co-curricular experiences to improve students' ethical development.

- **Finelli, C. J.**, Holsapple, M. A., Ra, E., Bielby, R. M., Burt, B. A., Carpenter, D. D., Harding, T. S., & Sutkus, J. A. (2012). An assessment of engineering students' curricular and co-curricular experiences and their ethical development. *Journal of Engineering Education, 101*(3), 469-494.

  Method: An ethical framework is designed and employed to study engineering students' ethical development. Almost 4,000 engineering students at 18 U.S. institutions were included in the study.

  Impact: The level of complexity of ethics instructions was found to be more influential than the quantity of instruction, and students' co-curricular experiences (especially leadership involvement) were found to enhance ethical development. These findings can be used to establish curricula that promote ethical development of engineering undergraduate students.

- Harding, T. S., Carpenter, D. D., & **Finelli, C. J.** (2012). An exploratory investigation of the ethical behavior of engineering undergraduates. *Journal of Engineering Education, 101*(2), 346-374.

  Method: A modified version of the Theory of Planned Behavior was evaluated by surveying 388 engineering students from three institutions.

  Impact: National reports call for increased ethics education, but it is unclear how engineering students incorporate ethical thinking into their decisions. Here, an ethical decision-making model successfully predicted cheating behavior. This model can inform institutional plans for improving ethics education.

- Harding, T. S., Carpenter, D. D., **Finelli, C. J.**, & Passow, H. J. (2004, June). Does academic dishonesty relate to unethical behavior in professional practice? An exploratory study. *Science and Engineering Ethics, 10*, 311–324.

  Method: One-hundred thirty engineering undergraduate students from two private universities, ranging from second year to fifth year, completed a 13-item survey characterizing their ethical behavior in and out of the classroom.

  Impact: Academic and professional dishonesty are shown to be linked. That is, practicing engineers who report cheating as students were also more likely to report violating workplace policies. Thus, improving ethical education for undergraduate students may lead to improved future ethical-decision making in the workplace.

- Harding, T. S., Mayhew, M. J., **Finelli, C. J.**, & Carpenter, D. D. (2007, Sep). The Theory of Planned Behavior as a model of academic dishonesty in humanities and engineering undergraduates. *Ethics and Behavior, 17*(3), 255–279.

  Method: A modified Theory of Planned Behavior was employed to survey 527 undergraduate students from three institutions to characterize behaviors and likelihood to engage in cheating.

  Impact: Cheating was found to be more prominent in engineering students than in humanities students. Furthermore, extent of cheating in high school predicted future cheating in college.

- Holsapple, M. A., Carpenter, D. D., Sutkus, J. A., **Finelli, C. J.**, & Harding, T. S. (2012). Framing faculty and student discrepancies in engineering ethics education delivery. *Journal of Engineering Education, 101*(2), 169-186.

  Method: Focus groups and interviews were conducted with students, faculty, and administrators at 18 institutions. Underlying themes and discrepancies between student and faculty perceptions of ethics were investigated.

  Impact: Results highlight a gap in faculty and student perceptions about ethics instruction; primarily, students do not perceive faculty as positive ethical role models beyond the laws-and-rules approach. Educators should consider the different viewpoints of faculty and students when designing curricula to promote ethical development.

- Mayhew, M. J., Hubbard, S. M., **Finelli, C. J.**, Harding, T. S., & Carpenter, D. D. (2009). Using structural equation modeling to validate the Theory of Planned behavior as a model for predicting student cheating. *Review of Higher Education, 32*(4), 441–468.

  Method: A modified Theory of Planned Behavior with a measure of moral reasoning was employed to survey 527 undergraduate students from three institutions to characterize behaviors and likelihood to engage in cheating.

  Impact: The Theory of Planned Behavior was validated as a tool for predicting student cheating. Thus, future studies can further investigate our current understanding of cheating and moral reasoning development of students.

- Passow, H. J., Mayhew, M. J., **Finelli, C. J.**, Harding, T. S., & Carpenter, D. D. (2006). Factors influencing engineering students' decisions to cheat by type of assessment. *Research in Higher Education, 47*(7), 643–684.

  Method: Six hundred forty-three undergraduate engineering students at 11 institutions were surveyed to better predict behaviors that lead to increased frequency of cheating on homework and exams.

  Impact: Academic dishonesty was found to be viewed by students not as a single construct. That is, type of assessment (homework versus exam) influenced their ethical behavior. Furthermore, students who reported that they would cheat to alleviate stress were found to be more likely to cheat on any assessment.

CREATIVITY AND DESIGN

- Adams, R., **Daly, S.**, Mann, L., & Dall'Alba, G. (2011). Being a professional: Three lenses on design thinking, acting, and being. *Design Studies, 32*(6), 588-607.

  Method: Three lenses to view design are presented, including 'an embodied understanding of professional practice' *and two tools to interpret and characterize design practices.*

  Impact: The three lenses can be utilized to develop a system for synthesizing design thinking and learning.

- **Daly, S.**, Adams, R., & Bodner, G. (2012). What does it mean to design? A qualitative investigation of design professionals' experiences. *Journal of Engineering Education, 101*(2), 187-219.

  Method: Phenomenography identified critical differences in how designers from different disciplines approach design.

  Impact: Designers can use six distinct design lenses – evidence-based decision making, organized translation, personal synthesis, intentional progression, directed creative exploration, and freedom – to identify new approaches to design.

- **Daly, S.**, Christian, J., Yilmaz, S., Seifert, C. M., & Gonzalez, R. (2012). Assessing design heuristics in idea generation within an introductory engineering design course. *International Journal of Engineering Education, 28*(2), 463-473.

  Method: Forty-eight freshman engineering students generated ideas for novel designs with a set of Design Heuristics Cards. Each card represented a method to create new designs and examples from existing products.

  Impact: Students utilizing Design Heuristics Cards ideated more developed and creative ideas than those who did not utilize the cards.

- **Daly, S.**, Mosysjowski, E., & Seifert, C. M. (2014). Teaching creativity in engineering courses. *Journal of Engineering Education, 103*(3), 417-449.

  Method: Seven engineering courses offered by a single university were studied to characterize the aspects of creativity that were taught and assessed and those that were not.

  Impact: The analysis suggested that improved pedagogy and assessments can be utilized to improve instruction related to creative skill development.

- **Daly, S.**, Yilmaz, S., Christian, J., Seifert, C. M., & Gonzalez, R. (2012). Design heuristics in engineering concept generation. *Journal of Engineering Education, 101*(4), 601-629.

  Method: The design practices and strategies of 36 engineering students and practitioners were studied. Transcripts and retrospective interviews were used to identify common design concept generation strategies.

  Impact: Over 60 unique design heuristic strategies were identified. Combined with previous work, this study shows instructors and practitioners how to effectively explore design spaces to generate novel and diverse solutions.

- Mohedas, I., **Daly, S.**, & Sienko, K. (2014). Students as design ethnographers: A case study of student capstone design teams. *International Journal of Engineering Education, 30*(4), 888-900.

  Method: Student perceptions were assessed by analyzing design report documents and conducting semi-structured interviews with three undergraduate engineering design teams (totaling 11 students).

  Impact: Common strategies and challenges students have in conducting design ethnography were identified, as were opportunities for pedagogical development.

- **Rasoulifar, G.**, Eckert, C., & Purdhomme, G. (2012). Supporting communication between product designers and engineering designers in the design process of branded products: A comparison of three approaches. *CoDesign, 10*(2), 1-15.

  Method: Three approaches to improving the communication between product designers and engineering designers are investigated: annotations, word mappings, and multiple-domain matrices.

  Impact: All three approaches were found to improve communication between product and engineering designers. The most appropriate technique depends on the designer's familiarity with the approach and its purpose.

- Tolbert, D., & **Daly, S.** (2013). First-year engineering student perceptions of creative opportunities in design. *International Journal of Engineering Education, 29*(4), 879-890.

  Method: First-year engineering students in project-based design courses were surveyed four times during the semester. The purpose of the survey was to better understand students' views on creativity, the extent of opportunities for creativity in student projects, and the way course structure and course instructor can influence students' creativity.

  Impact: Students identified aspects of course environments and type of instructor feedback that pushed them to choose more or less creative designs. This information can be used to guide development of design courses and to support students in pursuing more creative design solutions.

- Yilmaz, S., **Daly, S.**, Christian, J. L., Seifert, C. M., & Gonzalez, R. (2013). Can experienced designers learn from new tools? A case study of idea generation in a professional engineering team. *International Journal of Design Creativity and Innovation*, 1-15.

  Method: Professional engineers' design practices were studied to better understand how novel ideas are developed for longstanding product lines and whether Design Heuristics can help facilitate new ideas.

  Impact: By designing with Design Heuristics Cards, expert engineers developed new creative ideas for product lines that they had worked on for several years. They also identified additional opportunities for design modifications.

INSTRUCTIONAL TECHNOLOGY

- Green K., **Pinder-Grover, T.**, & Mirecki Millunchick, J. (2012). Impact of screencast technology: Connecting the perception of usefulness and the reality of performance. *Journal of Engineering Education, 101*(4), 717–737.

  Method: Undergraduate engineering students' use of screencasts as a learning tool was studied over two semesters. Students' screencast use was quantified and students' perceptions were collected. In addition, the relationship between screencast use and improved learning outcomes was investigated through a case study analysis.

  Impact: Students who perceived a high value of screencasts as a learning tool demonstrated increased understanding of material (i.e., higher course performance).

- Ohland, M. W., Loughry, M. L., Woehr, D. J., **Finelli, C. J.**, Bullard, L. G., Felder, R. M., Layton, R. A., Pomeranz, H. R., & Schmucker, D. G. (2012, Dec). The Comprehensive Assessment of Team Member Effectiveness: Development of a behaviorally anchored rating scale for self and peer evaluation. *Academy of Management Learning & Education, 11*(4), 609-630.

  Method: The Comprehensive Assessment of Team Member Effectiveness (CATME) is a web-based tool that uses a behaviorally-anchored rating scale to efficiently collect and analyze self- and peer-evaluation data. The development of CATME and potential uses are described.

  Impact: CATME is an instrument for instructors to assess team-member contributions in five areas of team effectiveness.

- **Pinder-Grover, T.**, Green K., & Mirecki Millunchick, J. (2011). The efficacy of screencasts to address the diverse academic needs of students in a large lecture course. *Advances in Engineering Education, 2*(3). 1-28.

  Method: Students were surveyed about their screencast experiences to understand their use-patterns and the value and usefulness they perceived the screencasts to have. Screencast usage was correlated with student performance to determine significance.

  Impact: The majority of students perceived screencasts to be helpful as a study supplement and to be a useful tool to introduce new topics. Students who accessed screencasts most frequently had the highest final grades. The greatest gains were found for students having the least previous exposure to course topics.

SCHOLARSHIP OF TEACHING AND LEARNING

- Oakley, B., & **Finelli, C. J.** (2014. May). Guest Editorial: A practical approach to understanding—and applying!—the scholarship of application. *IEEE Transactions on Education, 57*(2), 69–74.

  Method: Scholarship of application papers represent nearly 80% of all papers published by IEEE Transactions on Education. This paper reviews the new set of criteria developed to evaluate such papers.

  Impact: Systematic methods are outlined for researchers to design studies and present their findings in accordance with guidelines outlined for publication in IEEE Transactions on Education.

- Wright, M. C., **Finelli, C. J.**, & Meizlish, D. (2011). Facilitating the scholarship of teaching and learning at a research university. *Change: The Magazine of Higher Learning, 43*(2), 50-56.

  Method: In lieu of a faculty rewards system to encourage faculty participation in scholarship of teaching and learning, alternative means to encourage instructional improvement are investigated.

  Impact: Since 2008, the University of Michigan has provided faculty/postdoc/graduate-student teams with funding and personalized support to pursue scholarship of learning and teaching. The model can be applied at other institutions.

FACULTY AND TA DEVELOPMENT

- Bryan, L., Sederberg, D. **Daly, S.**, Sears, D., & Giordano, N. (2012). Facilitating teachers' development of nanoscale science, engineering, and technology content knowledge. *Nanotechnology Review, 1*, 85-95.

  Method: Twenty-four secondary science teachers enrolled in a year-long professional development program were studied. The program consisted of a two-week intensive course and follow-up activities during the year. Knowledge gains were assessed with a pre-, post-, delayed post-test design.

  Impact: Nanoscale science, engineering, and technology (NSET) is becoming an integral part of precollege curricula. Results suggest that this professional development program increased participants' NSET knowledge. These programs could be implemented at any secondary school interested in teaching NSET.

- **Daly, S.**, & Bryan, L. (2010). Model use choices of secondary teachers in nanoscale science and engineering education. *Journal of Nano-Education, 2*(1-2), 76-90.

  Method: Secondary teachers who incorporated nanoscale science and engineering lessons into their chemistry, physics, or biology course were studied. Classroom observations identified four distinct approaches to using models in the classroom: visualization, design, critique, and investigation.

  Impact: The four distinct approaches to using models can be utilized for planning professional development sessions.

- **Finelli, C. J., Daly, S. R**., & Richardson, K. M. (2014). Bridging the research-to-practice gap: Designing an institutional change plan using local evidence. *Journal of Engineering Education – Special Issue on the Complexities of Transforming Engineering Higher Education, 103*(2), 331-361.

  Method: Data were collected from faculty focus groups, classroom observations, and a student survey. A change plan was designed by analyzing data with a "who/what/how" decision-making process.

  Impact: An institutional change plan was developed that could be employed at any university to accelerate the adoption of effective teaching practices through faculty action and an administrative change.

- **Finelli, C. J.**, Ott, M., Gottfried, A. C., Hershock, C., O'Neal, C., & Kaplan, M. L. (2008). Utilizing instructional consultations to enhance the teaching performance of engineering faculty. *Journal of Engineering Education, 97*(4), 397–411.

  Method: Fifty-five courses were surveyed (49 unique instructors) by instructional consultants over two academic terms. Instructional consultations assessed efficacy of consultations based on different types of data including student ratings, videotaped class sessions, and data collected from midterm student feedback.

  Impact: This paper reports two main findings: consultations based on midterm student feedback have the largest positive impact, and the consultant plays a key role in interpreting the data and identifying strategies for improvement.

- **Finelli, C. J.**, **Pinder-Grover, T.**, & Wright, M. C. (2011). Consultations on teaching. Using student feedback for instructional improvement. In C. E. Cook & M. L. Kaplan (Eds.), *Advancing the Culture of Teaching at a Research University: How a Teaching Center Can Make a Difference* (pp. 65-79). Sterling, VA: Stylus Publishing.

  Method: In 2009-2010, U-M CRLT conducted more than 350 midterm student feedbacks for U-M faculty and teaching assistants, collecting feedback from over 15,000 students. The most common formative feedback from students and the most common faculty perceptions about receiving that feedback were identified.

  Impact: Formative student feedback has been shown to effectively enhance instructional practice and student learning. The U-M CRLT midterm student feedback procedure is described in detail.

- **Finelli, C. J.**, Wright, M. C., & **Pinder-Grover, T.** (2010). Consulting the Delphi: A new idea for collecting student feedback through the Two-Survey Method. *Journal of Faculty Development, 24*(2). 25-33.

  Method: The Two Survey Method, based on a Delphi technique, is investigated as a new tool to gather formative student feedback. The method utilizes iterative surveys to identify strengths and suggestions from students.

  Impact: The Two Survey Method can be utilized as a versatile, time-efficient tool to collect student feedback, supplement existing feedback, to check feedback reliability, or to develop actionable strategies.

- Kalish, A., Robinson, S., Border, L. L. B, Chandler, E. O., Connolly, M., Eaton, L. J., Gilmore, J., Griffith, L., Hanson, S., **Pinder-Grover, T.**, & von Hoene, L. (2012). Steps toward a framework for an intended curriculum for graduate and professional students: How we talk about what we do. In A. Kalish & S. Robinson (Eds.), *Studies in Graduate and Professional Student Development, 14* (pp. 163-173).

  Method: Teaching competencies were developed to categorize a variety of teaching-related professional development programs for graduate and professional students. Programs described in this special issue were examined to determine whether and to what extent the teaching competencies were discernable within the university programs.

  Impact: The teaching competencies can be used to identify the extent to which graduate education prepares students to become faculty instructors. In addition, learning objectives for an ideal intended curriculum are described.

- Meizlish, D. M., **Pinder-Grover, T.**, & Wright, M. C. (2012). Effective use of graduate peer teaching consultants: Recruitment, training, supervision, and evaluation. In K. Brinko (Ed.), *Practically Speaking* (pp. 307-313). Stillwater, OK: New Forums Press.

  Method: Two approaches to utilizing peer teaching consultants to support the mission of a teaching center are described: a disciplinary-based and a centralized approach.

  Impact: Peer teaching consultants are integral to supporting high standards expected from institutes and fellow graduate student instructors. Not only do peer teaching consultants provide critical support to their peers, but they also gain applicable knowledge and skills for their future endeavors.

- **Pinder, T.** (2007) Teaching practice: Emphasis on active learning. In C. Ross & J. Dunphy (Eds.), *Strategies for Teaching Assistant and International Teaching Assistant Development* (pp. 76-79). San Francisco, CA; Jossey-Bass.

  Method: An activity is described to provide teaching assistants with hands-on experience engaging students during lecture. Teaching assistants reflect on their teaching by reviewing video of their lesson, answering reflection questions, and receiving immediate peer feedback on student understanding.

  Impact: An activity is developed to train up to a group of five teaching assistants in 90 minutes. To train large groups of teaching assistants, multiple moderators are required (e.g., 24 moderators for 120 teaching assistants).

- **Pinder-Grover, T.**, Meizlish, D. M., & Wright, M. (2011). Graduate peer teaching consultants: Expanding the center's reach. In C. Cook (Eds.) *Advancing the Culture of Teaching at a Research University: How a Teaching Center Can Make a Difference* (pp. 80-96). Sterling, VA: Stylus Publishing.

  Method: Since 1997, the University of Michigan Center for Research on Learning and Teaching has trained peer teaching consultants to interact with graduate student instructors and undergraduate teaching assistants.

  Impact: Peer teaching consultants were shown to improve the standard of teaching at U-M while simultaneously gaining further insight into their own teaching practices. Relevant lessons are outlined for institutions wishing to develop a similar program.

- **Pinder-Grover, T.**, Milkova, S., & Hershock, C. (2012). Training TAs as Consultants at the University of Michigan: Workshop Series for Peer Mentors. In K. Brinko (Ed.), *Practically Speaking* (pp. 225-245). Stillwater, OK: New Forums Press.

  Method: Four interactive workshops were designed to train coordinators of departmental teaching assistant training. Workshops support the diverse needs of multiple units while maintaining high standards of teaching.

  Impact: The goals, activities, rationale for activities, and workshop variants are described with sufficient detail to be implemented at any institution. Within each workshop, teaching assistants appreciated opportunities for conversation about teaching, opportunities to brainstorm, and the chance to reflect and discuss teaching.