

THE CENTER FOR RESEARCH ON LEARNING AND TEACHING IN ENGINEERING

2010–2011

Report for College of Engineering



UNIVERSITY OF MICHIGAN

Authored by Cynthia Finelli

CRLT IN ENGINEERING

2010–2011

Report for College of Engineering

Overview.....	1
CRLT in Engineering Advisory Board.....	2
College-wide programs.....	2
CRLT in Engineering Seminar Series	3
Support for engineering education researchers.....	3
Programs for new instructors.....	3
Awards and grants.....	4
CRLT theater performances.....	6
Programs through the main CRLT.....	6
Services for individual instructors	7
Classroom interventions for faculty	7
Teaching-related consultations	9
Consultations on proposal preparation.....	9
Long-term collaborations with instructors.....	9
Services for administrators and the broader community.....	10
Consultations for administrators and staff.....	10
Provost’s Campus Leadership Program.....	10
Teaching and guest lecturer opportunities	11
Committee service.....	11
Regular meetings with administrators	11
CRLT in Engineering website	11
Services for students and postdoctoral fellows.....	12
Engineering Teaching Consultant Program	12
Preparing Future Faculty (PFF) events.....	13
Graduate Teacher Certificate program	13
Postdoctoral Short Course.....	13
National leadership	14
Honors and awards.....	14
National service.....	14
Participation in workshops and conferences	14
Consultations outside of U-M.....	15
Research in engineering education	16
Research grants submitted.....	19
Refereed journal publications (or equivalent) in print or accepted.....	19
Refereed conference proceedings	20
Poster presentations	21
CRLT in Engineering staff	22

OVERVIEW

In February, 2011, the Center for Research on Learning and Teaching North (CRLT North) was **renamed to CRLT in Engineering**. The new name more accurately portrays the partnership that was established in 2004 between the university-wide CRLT (which serves all 19 schools and colleges at U-M) and the College of Engineering. It also reflects the joint reporting structure of CRLT in Engineering to both CRLT and CoE. Goals for CRLT in Engineering include:

- Delivering high-quality professional development programs for faculty and student instructors,
- Consulting with individuals and units wishing to promote a culture of outstanding teaching and learning,
- Supporting faculty engaged in research and scholarship in engineering education, and
- Planning and conducting rigorous research in engineering education.

Some highlights of the engineering services provided by staff from both CRLT in Engineering and the main CRLT during the 2010–2011 academic year follow.

NEW INITIATIVES

- CRLT in Engineering staff partnered with faculty from Chemical Engineering to explore ways to introduce new pedagogies in large courses. The impact of the project is being studied.
- The engineering GSI teacher orientation program was tailored for undergraduate instructional aides (IAs) and mandatory for the first time. More than 50 IAs attended the program during 2010–2011.
- CRLT in Engineering took over responsibility for the CoE Outstanding GSI Award. Four graduate students received the honor.

COLLEGE-WIDE PROGRAMS

- CRLT in Engineering offered twelve sessions for the CRLT in Engineering Seminar Series, which had an overall attendance of 230 (189 unique individuals).
- There were 304 new instructors (290 unique individuals) at CRLT in Engineering programs for new engineering faculty, GSIs, and undergraduate instructional aides. CRLT in Engineering staff had face-to-face interactions with 14 (82%) of the 17 new faculty hired in 2010–2011.

CONSULTATIONS AND CLASSROOM INTERVENTIONS

- CRLT in Engineering provided 49 Midterm Student Feedback sessions or other classroom interventions for 15 faculty and 27 GSIs/IAs, allowing more than 1708 students to provide feedback to their instructors.
- Staff from CRLT in Engineering (including Engineering Teaching Consultants) conducted 65 consultations with faculty or administrators and 90 with students or postdoctoral fellows in engineering.
- CRLT in Engineering staff consulted with 29 individuals at 24 organizations and institutions outside U-M.

RESEARCH AND SCHOLARSHIP IN ENGINEERING EDUCATION

- CRLT Staff supported others' efforts by consulting with almost 40 individuals writing proposals, coordinating 17 poster presentations at the annual "Research and Scholarship in Engineering Education" poster fair, and coordinating a series of grant-writing and networking meetings.
- Engineering faculty pursuing scholarship in engineering education were awarded grants totaling \$53,925 (through CoE funds and through grants administered by the main CRLT).
- Staff from CRLT in Engineering engaged in nine research projects, submitted five NSF grant proposals, and published 29 refereed journal or conference publications.

CRLT IN ENGINEERING ADVISORY BOARD

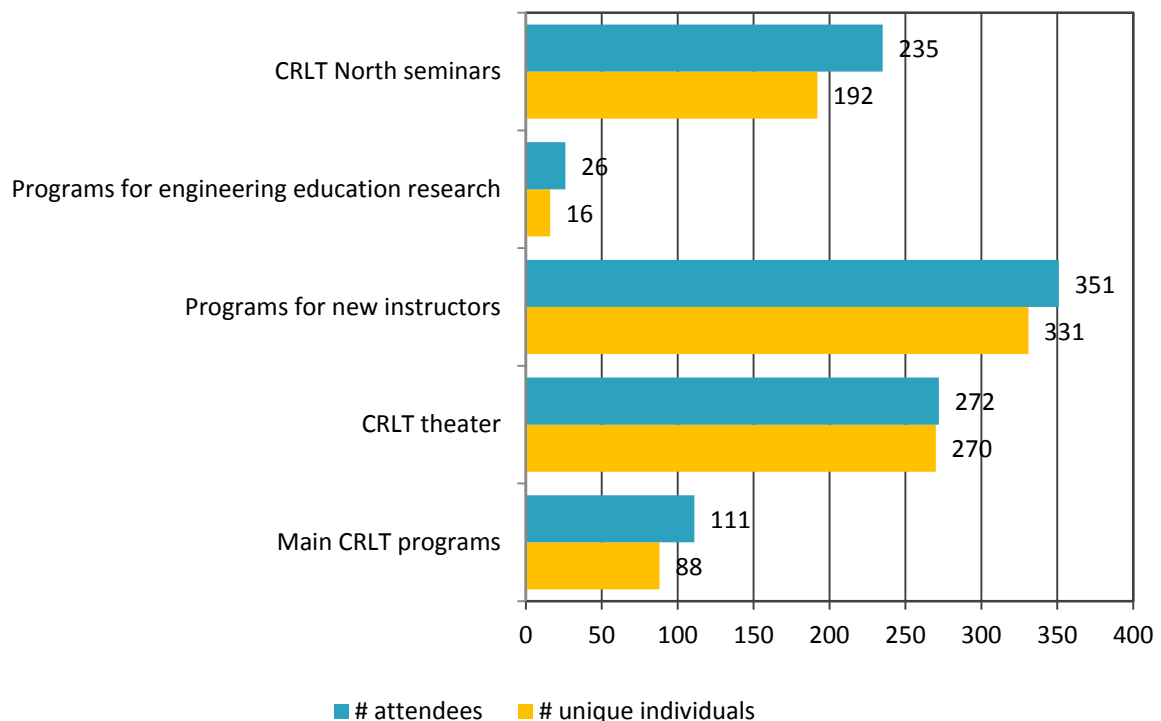
The CRLT in Engineering Advisory Board provides guidance and insight about CRLT in Engineering programs and advocates for CRLT in Engineering within the engineering community. In 2010–2011, the board assisted in selecting the College of Engineering’s Outstanding GSI Award and reviewed proposals for the Curricular Innovations in Undergraduate Engineering Education grant.

- Members of the board include:
 - Krzysztof Fidkowski, Aerospace Engineering
 - John Foster, Nuclear Engineering and Radiologic Sciences
 - Jessy Grizzle, Electrical Engineering and Computer Science
 - Jerome Lynch, Civil and Environmental Engineering
 - Joanna Mirecki-Millunchick, Materials Science and Engineering
 - Mark Moldwin, Atmospheric, Oceanic and Space Sciences
 - Margaret Wooldridge, Mechanical Engineering

COLLEGE-WIDE PROGRAMS

CRLT in Engineering provides several college-wide programs to promote a culture of teaching and learning in engineering. These include the CRLT in Engineering Seminar Series, programs to support engineering education research, activities for new engineering instructors, performances by the CRLT Players theater troupe, and university-wide programs planned by the main CRLT office. Altogether, **these programs had an attendance of 634 (504 unique individuals)**. Additionally, CRLT in Engineering and the main CRLT coordinate several education-related grants.

ATTENDANCE AT COLLEGE-WIDE PROGRAMS



CRLT IN ENGINEERING SEMINAR SERIES

- In 2010–2011, there were 235 attendees (representing 192 unique individuals) at the following 12 programs in the CRLT in Engineering Seminar Series:
 1. *77 Cards: A tool to help designers generate diverse and creative design solutions*
 2. *Building on the math foundation of engineering*
 3. *Designing the design experience: Advice from faculty who succeed.* A faculty panel featuring Michael Flynn, Joaquim Martins, Kathleen Sienko, and Steve Skerlos
 4. *Fifth annual research and scholarship in engineering education poster session.* 17 posters on display
 5. *If I only knew then: Lessons from a panel of experienced GSIs*
 6. *It's time for action: Generating an active learning plan*
 7. *Lenses on learning: Different styles for different people*
 8. *Spicing up teaching to spice up student learning*
 9. *The art of juggling: Balancing work and life*
 10. *Using technical writing to enhance and assess student understanding*
 11. *Ways that work: Effective lecturing in engineering*
 12. *What do I do now? Strategies for handling sticky situations with students*

SUPPORT FOR ENGINEERING EDUCATION RESEARCHERS

- CRLT in Engineering coordinates several programs to support others engaged in engineering education research. There were 26 attendees (representing 16 unique individuals) at the following programs:
 - Series of three NSF webinars:
 - *Introduction to the TUES program*
 - *Developing a competitive proposal*
 - *Project evaluation*
 - Networking meetings for faculty in engineering, education, and psychology

PROGRAMS FOR NEW INSTRUCTORS

CRLT in Engineering offers programs to support new instructors as they prepare for teaching. In 2010–2011, these activities had an attendance of 351 (331 unique instructors).

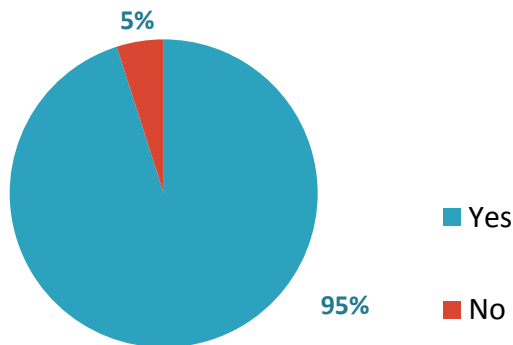
NEW ENGINEERING FACULTY WORKSHOPS

- CRLT in Engineering offered six workshops for new engineering faculty. There were 51 in attendance (representing 38 unique individuals; postdoctoral fellows were invited to attend the NSF CAREER Proposal workshop):
 1. *College of Engineering New Faculty Orientation*, featuring a faculty panel on teaching at U-M (with Lola Eniola-Adefeso, Mark Moldwin, Ken Powell, and Clayton Scott) and practice teaching
 2. *Networking with senior engineering faculty*
 3. *Overview of CRLT in Engineering* at the Keys to the College session
 4. *Preparing an NSF CAREER Proposal*
 5. *Strategies for new faculty success*

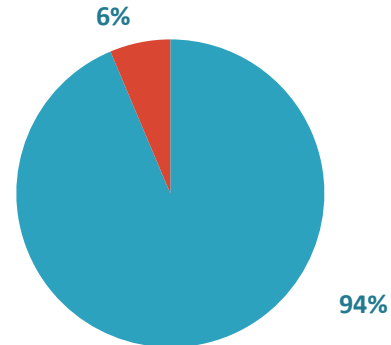
ENGINEERING GSI/IA TEACHER ORIENTATION

- Each term, CRLT in Engineering coordinates the mandatory teacher orientation program for new GSIs and IAs. It includes an all-day training program and two practice teaching sessions, and there is a make-up program to accommodate late GSI/IA assignments. **Altogether, 309 unique students attended the orientation programs,** and ratings of the program continue to be high, as shown below.

Would you recommend the program?



Do you feel well prepared to teach?

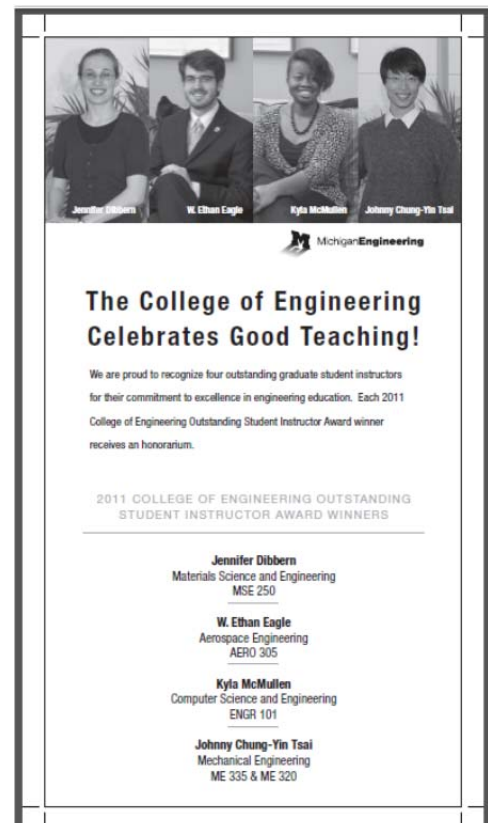


“The [Engineering GSI Teacher Training] program was very effective at introducing a comprehensive foundation of GSI’ing.”
GSI who participated in teacher training in Winter 2011

AWARDS AND GRANTS

COE OUTSTANDING GSI AWARD

- For the first time, this award to recognize outstanding graduate student teaching was managed by CRLT in Engineering. Members of the CRLT in Engineering Advisory Board, as well as others, reviewed the nominations. \$1,000 awards were made to the following GSIs this year (and winners were announced in the Michigan Daily):
 - Johnny Chung-Yin Tsai, Mechanical Engineering
 - Jennifer Dibbern, Materials Science and Engineering
 - Ethan Eagle, Aerospace Engineering
 - Kyla McMullen, Undergraduate Education



CURRICULUM INNOVATION IN UNDERGRADUATE ENGINEERING EDUCATION GRANT

- Staff from CRLT in Engineering coordinated the proposal application and review process for the awards. The following \$5,000 awards were made:
 - David Chesney, Electrical Engineering and Computer Science
Integrating handheld devices addressing health care issues through the electrical engineering curriculum
 - Lola Eniola-Adefeso, Chemical Engineering
Incorporation of self-directed learning and K12 outreach into the chemical engineering curriculum at U-M

GRANTS ADMINISTERED THROUGH THE MAIN CRLT

In 2010–2011, the main CRLT office administered several grants competitions for faculty to improve teaching and learning, and engineering faculty were very competitive for these grants. **Eight engineering proposals were funded for a total of \$40,925 (with additional matching funds totaling \$8,000 provided by CoE).**

- **Investigating Student Learning (ISL) Competition.** Through the ISL competition, engineering awardees attend an all-day symposium on scholarship of teaching and learning, work with staff from CRLT in Engineering to conduct education research on student learning, and present their work at the year-end ISL poster session. This year, the following engineering awards were made (and CoE provided \$8,000 in matching funds) :
 - Alexander Ganago, Electrical Engineering and Computer Science & Hongwei Liao, graduate student, Electrical Engineering and Computer Science
Student learning in a required course for non-majors: Perception of values for future multidisciplinary teamwork, \$4,000
 - Jeffrey Ringenberg, Industrial and Operations Engineering & Marcial Lapp, graduate student, Industrial and Operations Engineering
Predicting student achievement in a first-year introductory programming course, \$4,000
- **Other Grant Competitions.** Engineering faculty were also awarded the following six grants through the Faculty Development Fund, Instructional Development Fund, Stages I and 2 of the Gilbert Whitaker Fund for the Improvement of Teaching, and the Teaching with Technology Institute:
 - Harvey Bell, Undergraduate Education; Shanna Daly, Undergraduate Education; Gail Hohner, Multidisciplinary Design Program; & Brian Gilchrist, Electrical Engineering and Computer Engineering
An analysis of creative design opportunities in ENG 100
Stage 1 Whitaker Fund, \$10,000
 - Robin Fowler, Undergraduate Education
Computer mediated collaboration platform for group decision making in engineering design projects
Teaching with Technology Institute, \$2,500
 - Christian Lastoskie, Civil and Environmental Engineering
Harvesting the wind: A wind farm project design experience for energy infrastructure systems education
Faculty Development Fund, \$4,425
 - Mark Moldwin, Atmospheric, Oceanic and Space Sciences
Dorm room labs
Instructional Development Fund, \$500
 - Gabor Orosz, Mechanical Engineering
Experimental demonstrations of gyroscopic effects. Instructional Development Fund, \$500
 - Panos Papalambros, Mechanical Engineering; Richard Gonzalez, Psychology; & Shanna Daly, Undergraduate Education
Teaching design heuristics for creative and diverse concept generation
Stage 2 Whitaker Fund, \$15,000

CRLT THEATER PERFORMANCES

- The CRLT Players Theater Troupe performs sketches that engage faculty and graduate students in discussions of diversity, effective pedagogy, and institutional climate. In 2010–2011, the **CRLT Players had the following six performances that included 272 engineers (representing 270 unique individuals) in the audience:**
 - *Climate in the Classroom*, addressing diverse student perspectives and international experiences in the engineering classroom (two performances)
 - *Institutional Change: The Musical*, using unconventional music and staging to depict factors that affect institutional change
 - *Staff Vignettes*, focusing on the interactions of support staff and their key administrators and addressing difficulties of managing staff dynamics
 - *The First Class*, showing student viewpoints on a variety of classroom practices and approaches (two performances)

PROGRAMS THROUGH THE MAIN CRLT

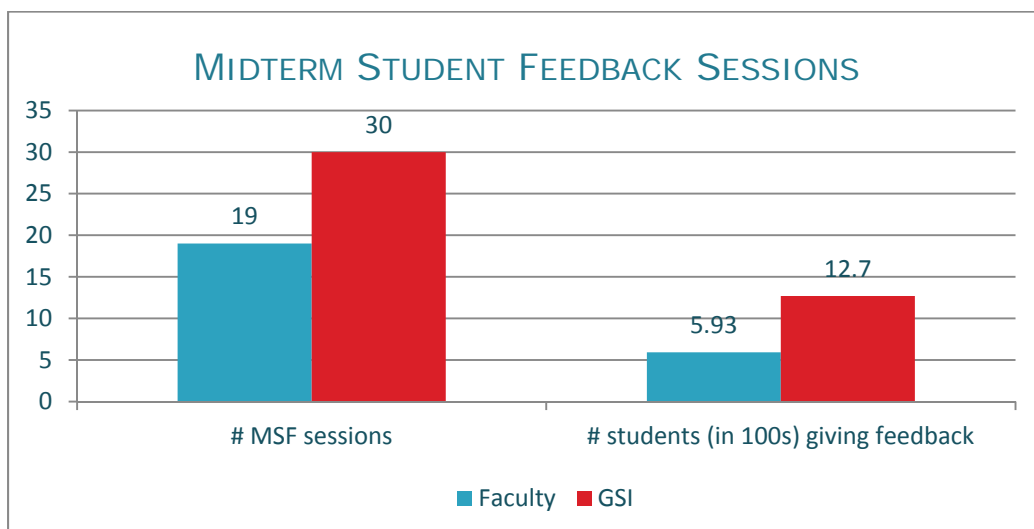
- There were 111 engineering participants (representing 88 unique individuals) at the following activities offered by the main CRLT office:
 - 46 faculty and GSIs (representing 34 unique individuals) at 11 *CRLT Seminar Series* events
 - 22 participants (13 unique individuals) at the *Enriching Scholarship* program in Spring 2011
 - 16 engineering faculty at the *International Faculty Dinner*
 - Eight engineering faculty and five GSIs at the *Teaching Innovation Prize/Investigating Student Learning poster fair*
 - Eight new engineering faculty at the university-wide *New Faculty Orientation*
 - Six engineering faculty at the Provost's Seminar on Teaching titled *PSOT on Educating Globally Competent Students*

SERVICES FOR INDIVIDUAL INSTRUCTORS

CRLT in Engineering provides a comprehensive range of services for individual instructors that includes classroom interventions (such as midterm student feedbacks), teaching-related consultations, consultations on proposal preparation, and long-term collaborations.

CLASSROOM INTERVENTIONS FOR FACULTY

- Staff from CRLT in Engineering conducted:
 - **19 Midterm Student Feedback sessions for 15 engineering faculty, allowing more than 590 students to provide feedback on faculty teaching** (interventions for GSIs are documented elsewhere in this report).
 - Two consultations based on a class observation for one faculty member.



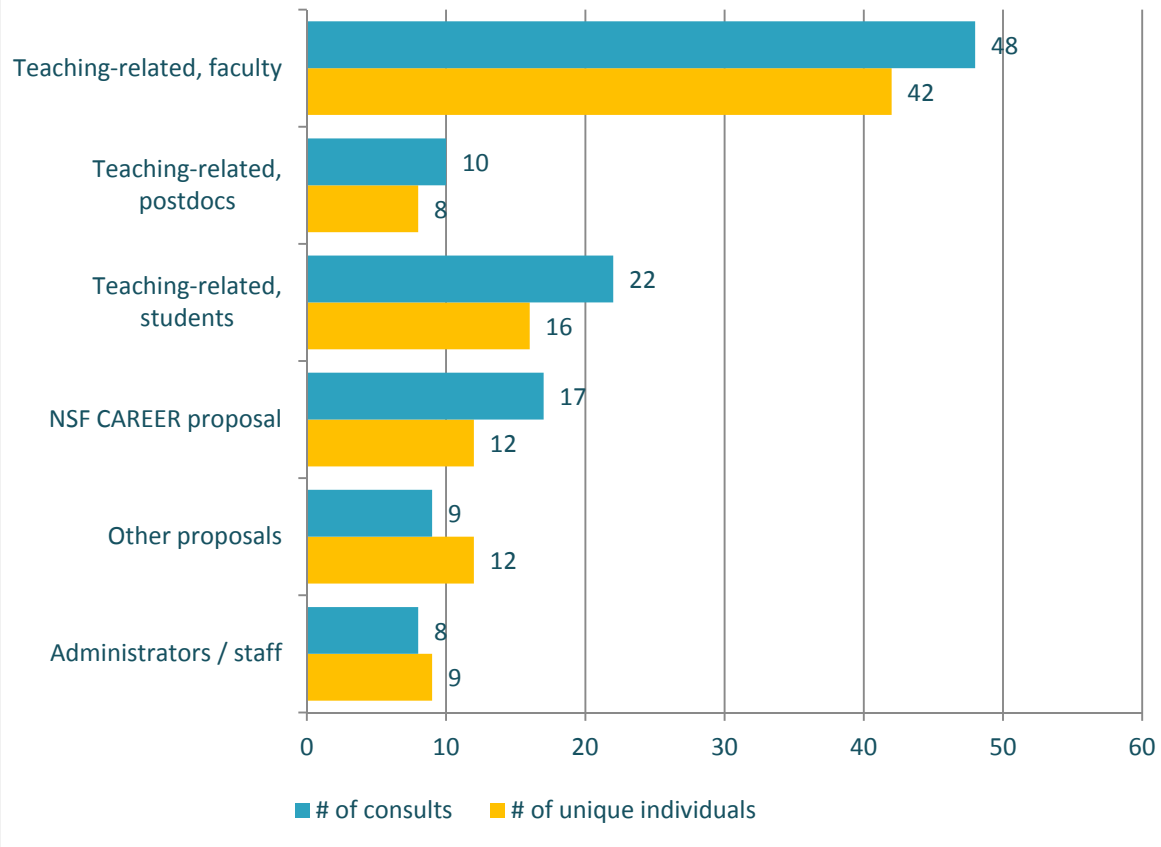
“I did discuss the [MSF] results in today's lecture, and indeed implemented your suggestions on teamwork for solving in-class problems. The results are surprisingly good. Thanks for your advice and your persistence to persuade me to implement it.”

*Experienced engineering faculty member
having an MSF after several terms of teaching, Fall 2010*

“I received the [MSF] feedback very promptly, which allowed me to adjust things quickly to meet the students' needs. An excellent service, very valuable.”

*Associate Professor having an MSF during
first term at U-M, Fall 2010*

CONSULTATIONS BY CRLT IN ENGINEERING STAFF



TEACHING-RELATED CONSULTATIONS

- Staff from CRLT in Engineering and the main CRLT conducted:
 - 48 consultations for 42 unique faculty
 - 10 consultations for eight postdoctoral fellows
 - 22 consultations for 16 students

CONSULTATIONS ON PROPOSAL PREPARATION

- Staff conducted **17 consultations with 12 assistant professors about the NSF CAREER Proposal.**

“I was awarded the NSF CAREER this year, which I believe I couldn’t have without your help preparing the educational part of it. So, thank you!”

Assistant Professor who was awarded the CAREER grant in 2010

“Thank you very much for your comments [about my NSF CAREER proposal]. These give me specific guidance and ideas to improve my education and outreach plan. I really appreciate it.”

Assistant Professor who was awarded the CAREER grant in 2010

- Staff conducted **nine consultations with 12 unique faculty preparing NSF proposals (other than the CAREER)** for the following programs:
 - Ethics Education in Science and Engineering (EESE)
 - Research and Evaluation on Education in Science and Engineering (REESE)
 - Research Experiences for Undergraduates (REU)
 - Research Initiation Grants in Engineering Education (RIGEE)
 - Science and Technology Centers (STC)
 - Transforming Undergraduate Education in STEM (TUES)
- Staff from CRLT in Engineering conducted **five consultations with nine individuals related to their CRLT Investigating Student Learning projects.**

LONG-TERM COLLABORATIONS WITH INSTRUCTORS

- CRLT in Engineering staff engaged in long term collaborations with faculty and staff on the following projects:
 - Assessing Multidisciplinary Design Minor
 - Evaluating EECS 314 Control Lab
 - Introducing new pedagogies in large chemical engineering courses
 - Studying curriculum initiatives for NSF Course Curriculum and Laboratory Improvement (CCLI) project

SERVICES FOR ADMINISTRATORS AND THE BROADER COMMUNITY

To support administrators, staff, and the broader community, CRLT in Engineering staff offers consultations, programs, and presentations, and the main CRLT office coordinates the Provost's Campus Leadership Programs (which is attended by new CoE department chairs, among others). Additionally, staff assume a variety of teaching responsibilities (for full courses and as a guest lecturer), serve on numerous committees, and have regular meetings with administrators to ensure that programming meet the needs of the community. CRLT in Engineering publicizes ongoing teaching and learning initiatives through its website.

CONSULTATIONS FOR ADMINISTRATORS AND STAFF

- Staff from CRLT in Engineering and the main CRLT conducted eight consultations for 11 staff and administrators (nine unique individuals) on topics that included:
 - Coordinating library resources for engineering education research
 - Creating an ethics sketch for introductory engineering courses
 - Describing teaching and learning initiatives for ABET self-study
 - Developing an action plan for lecturer reappointment
 - Incorporating sexual harassment training in engineering GSI orientation
 - Promoting good teaching in the IOE Department
 - Reviewing report of Sustainability and Ethics Task Force
 - Teaching moral content in the undergraduate curriculum

PROGRAMS AND PRESENTATIONS FOR ADMINISTRATORS AND STAFF

- Staff from CRLT in Engineering and the main CRLT collaborated with administrators and staff to develop and (co-) facilitate programs on:
 - Campus-wide mentoring initiative with Rackham, the Mentoring Others Results in Excellence Program, and the Alliance for Graduate Education and the Professoriate
 - Overview of math curriculum
 - Sustainability for faculty teaching first year courses
 - Using and assessing student writing
- Staff from CRLT in Engineering made the following presentations:
 - Overview of CRLT in Engineering at meetings of the CoE Executive Committee, CoE Department Chairs, and CoE Program Directors
 - Discussion about teacher orientation for GSIs and IAs at meetings of the CoE Department Chairs and CoE GSI Coordinators
 - Discussion about ways to evaluate teaching at meeting of the CoE Department Chairs

PROVOST'S CAMPUS LEADERSHIP PROGRAM

- The main CRLT office worked with the Provost's Office to organize the Campus Leadership Program, an orientation for new chairs and associate deans and monthly sessions for both new and experienced ones.
 - During the year, there were 17 engineering attendees (seven unique deans or chairs) at seven separate sessions.

TEACHING AND GUEST LECTURER OPPORTUNITIES

- Staff from CRLT in Engineering had the following teaching responsibilities:
 - *UARTS 101 & 102: Creative Process and Collaboration* (Fall 2010 and Winter 2011). Designed and co-taught interdisciplinary freshman course on creative process skill development
 - *ENG 490: Design Primer* (Winter 2011): Co-designed and co-taught course on design processes and approaches to various phases of design
- Staff from CRLT in Engineering made guest lecture presentations in the following classes:
 - *ENG 580: Teaching Engineering*
 - *ME 455 / DESCI 501 / ARTDES 300: Analytical Product Design*
 - *ENG 100: Introduction to Engineering* (two separate sections)

COMMITTEE SERVICE

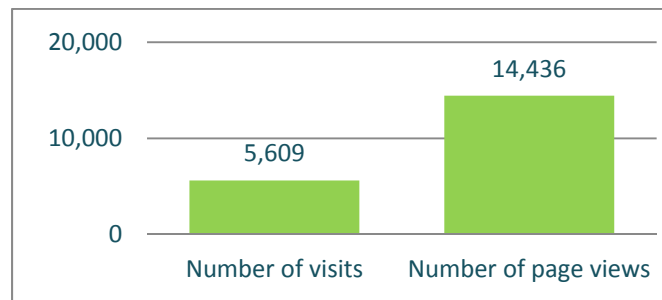
- Staff from CRLT in Engineering regularly participated on the following committees:
 - Faculty Advisory Council of the Center for Engineering Outreach and Diversity
 - All-Hands group of the Associate Dean for Undergraduate Education
 - U-M Responsible Conduct of Research Task Force
- Staff from CRLT in Engineering also served on:
 - Dissertation committee for Design Science Ph.D. student (faculty co-advisor)
 - Diversity Advisory Board for NSF proposal on Energy-Efficient Ultra-dense Computing
 - Promotion review committee for assistant research scientist

REGULAR MEETINGS WITH ADMINISTRATORS

- CRLT in Engineering met as needed to consult about faculty development, teaching-related issues, and GSI training with the following administrators:
 - Associate Dean for Undergraduate Education
 - Associate Dean for Academic Affairs
 - Director of Academic Programs
 - Managing Director of the Office of Academic Affairs

CRLT IN ENGINEERING WEBSITE

- The website had 5,609 visits and 14,436 page views.



SERVICES FOR STUDENT INSTRUCTORS & POSTDOCTORAL FELLOWS

CRLT in Engineering provides an array of programs for postdoctoral fellows, graduate students, and undergraduate instructional aides (IAs) in engineering. These include the Engineering Teaching Consultant program, support at department orientations, several Preparing Future Faculty events, the Graduate Teacher Certificate (administered by the main CRLT), and a course on college teaching for postdocs.

ENGINEERING TEACHING CONSULTANT PROGRAM

- CRLT in Engineering hires, trains, and manages the Engineering Teaching Consultant (ETCs), a group of experienced GSIs who work in teams to serve the entire engineering GSI/IA population by mentoring 70-90 GSIs/IAs per team. **In the fall and winter, respectively, ETCs served 310 and 295 GSIs/IAs. ETCs provided 240 separate services in all.**

THE ENGINEERING TEACHING CONSULTANTS



Fall 2010



Winter 2011

SERVICES PROVIDED BY ENGINEERING TEACHING CONSULTANTS

Type of service	Fall 2010	Winter 2011	Total
Midterm Student Feedback sessions	13	16	29
▪ Number of students offering feedback	566	704	1,270
Other classroom interventions	6	8	14
Consultations on teaching	45	56	101
Attendance at group consultations or activities	38	58	96
Total services	102	138	240

DEPARTMENT GSI ORIENTATIONS

- ETCs were present at several department orientations. Approximately 146 students attended programs held by the following departments:
 - Chemical Engineering
 - Electrical Engineering & Computer Science
 - Industrial and Operations Engineering
 - Mechanical Engineering

PROFESSIONAL DEVELOPMENT FOR ETCs

- CRLT in Engineering held an informational session about the ETC program that was attended by four potential ETCs. Two who attended were subsequently hired as ETCs.
- ETCs attended biweekly professional development programs on topics that included:
 - Academic integrity
 - Active learning techniques
 - Discussion with the Associate Dean for Undergraduate Education
 - Engineering education research
 - Faculty/GSI interactions
 - Inquiry based learning
 - Midterm Student Feedbacks
 - Program overview and ways to know your GSIs/IAs
 - Women in Engineering

PREPARING FUTURE FACULTY (PFF) EVENTS

- *Month-Long Seminar on College Teaching.* In May, CRLT in Engineering staff co-directed the *Eleventh Annual Rackham/CRLT May Seminar on Preparing Future Faculty*, and three engineering students participated (out of 50 total).
- *One-day PFF Conference.* The main CRLT office offered a one-day conference, *Getting Ready for an Academic Career*. 56 engineering graduate students and postdocs participated (out of 302 total).
- *Mentoring Program.* The *Rackham/CRLT Graduate Student and Postdoc Mentorship Program* brings together U-M graduate students and faculty from nearby colleges and universities to explore faculty work-life and the academic job search. Four mentor / mentee pairs (out of 25 total) involved engineering graduate students.

GRADUATE TEACHER CERTIFICATE PROGRAM

- With the Rackham School of Graduate Studies, the main CRLT office coordinates a program for graduate students across the university to earn a *U-M Graduate Teacher Certificate*.
 - Seven of the 54 students who completed certificates in 2010–2011 were engineering students.

POSTDOCTORAL SHORT COURSE

- Five of 32 participants in the seven week *Rackham/CRLT Postdoctoral Short Course on College Teaching in Science and Engineering* were engineering postdocs.

NATIONAL LEADERSHIP

CRLT in Engineering is dedicated to providing national leadership to enhance the visibility of U-M in engineering education. As such, CRLT in Engineering serves on national committees and review boards, participates in national workshops and conferences, and provides consultations for individuals outside the U-M community.

HONORS AND AWARDS

CRLT in Engineering staff earned the following honors:

- 2010 Design Computing and Cognition Conference, *Best Design Cognition Paper Award*
- ASEE Educational Research and Methods Division, *Distinguished Service Award*
- ASEE Professional Interest Council V, *Best Paper Award* for 2010 ASEE Conference

NATIONAL SERVICE

During 2010–2011, staff at CRLT in Engineering served in the following national leadership roles:

- Chair, *NSF Transforming Undergraduate Education in STEM (TUES) Community of Scholars Panel*
- Co-leader, national effort to network Engineering Education Centers and Programs
- Guest editor, special issue of *International Journal of Engineering Education* on applications of engineering education research
- Member, *Frontiers in Education Conference Steering Committee*
- Reviewer for:
 - *ASEE Annual Conference & Exposition, 2011*
 - *Frontiers in Education Conference, 2011*
 - *Journal of Engineering Education*
 - *Journal of Science and Technology Education*
 - *Journal of Science Teacher Education*
 - *NSF Research in Engineering Education (REE) Division proposals*
 - *Science Education*

PARTICIPATION IN WORKSHOPS AND CONFERENCES

- CRLT in Engineering staff attended the following conferences to share research results, participate in professional development, and increase U-M national visibility:
 - *2010 Annual ASEE Conference & Exposition, Louisville, KY*
 - *40th IEEE/ASEE Frontiers in Education Conference, Arlington, VA*
 - *Design Computing and Cognition Conference, Stuttgart, Germany*
 - *Engaged STEM Learning: From Promising to Pervasive Practices, Miami, FL*
 - *Harvey Mudd Design Workshop, Claremont, CA*
 - *NSF Centers for Teaching and Learning Workshop, Arlington, VA*
 - *NSF Engineering Education Centers (EEC) Division Awardees Conference, Arlington, VA*

CONSULTATIONS OUTSIDE OF U-M

● Staff conducted consultations for 29 unique individuals at the following 24 organizations outside of U-M:

- American Society of Engineering Education
- DEGW North America (design consultants)
- Eastern Michigan University
- Georgia Institute of Technology
- Georgia Institute of Technology
- Iowa State University
- Johns Hopkins University
- Kettering University
- Lawrence Technological University
- Linfield College
- Methodist College of Nursing
- Michigan State University
- Nanyang Technology University
- National Autonomous University of Mexico
- No institutional affiliation
- Pennsylvania State University
- Pontificia Universidad Católica
- Shanghai Jiao Tong University Joint Institute
- Stanford University
- Texas A&M University
- University of Massachusetts, Amherst
- University of Pittsburgh
- University of Tokyo (Todai)
- University of Washington
- Virginia Technologic Institute

RESEARCH IN ENGINEERING EDUCATION

CRLT in Engineering recognizes the importance of its role in reforming engineering education and furthering the mission of the college to promote excellence in engineering education. In addition to supporting others who pursue scholarship in engineering education, CRLT in Engineering conducts its own research. In particular, staff:

- Actively pursued **nine major research initiatives**
- Submitted **five grant proposals**
- Had **12 refereed journal manuscripts and 17 refereed conference proceedings** accepted or published

RESEARCH ACTIVITIES BY CRLT IN ENGINEERING STAFF

Title and Project Team	Project Description and Activities
<p>ACTIVITIES THAT PROMOTE ETHICAL DEVELOPMENT OF ENGINEERING UNDERGRADUATES</p> <p>Project team: Cynthia Finelli, Donald Carpenter (Lawrence Technological University), Trevor Harding (California Polytechnic State University), Janel Sutkus (Carnegie Mellon University), and five U-M graduate students</p>	<ul style="list-style-type: none">○ The project, funded by an <i>NSF Engineering Education Centers</i> award and involving 19 partner institutions, is designed to answer the question: What activities (in the formal and/or informal engineering curriculum) have the most positive impact on the ethical development of engineering undergraduates?○ The team analyzed quantitative survey data (completed by 3,914 undergraduate engineering students at 19 institutions) and qualitative focus group/interview data (from 123 students, 110 faculty, and 36 administrators). Select findings include:<ul style="list-style-type: none">▪ Co-curricular involvement (especially leadership) can enhance ethical development▪ Students with higher levels of ethical reasoning are less likely to be satisfied with their ethics instruction▪ Level of complexity of ethics instruction is more influential than the amount of ethics instruction○ The team has prepared individualized campus reports for all 19 partner institutions and will conduct three regional workshops and a national one in Fall 2011. The team also submitted an NSF proposal to continue its work.
<p>MOTIVATING CHANGE IN FACULTY TEACHING PRACTICES TO SUPPORT A DIVERSE STUDENT BODY IN ENGINEERING</p> <p>Project team: Cynthia Finelli, Shanna Daly, and James Holloway</p>	<ul style="list-style-type: none">○ This project, supported through an <i>NSF Course, Curriculum, and Laboratory Improvement</i> award, is intended to promote substantive and sustained changes in teaching practices to improve student success and support a diverse student body in engineering. The premise of the research is that, to achieve the greatest impact, efforts must be: (1) grounded in research about successful teaching practices, (2) integrated with local evidence about institutional context and faculty/student perspectives, and (3) informed by literature on institutional change models, faculty development research, and learning theory.○ In Winter 2011, the team observed 26 undergraduate, engineering, lecture-based classes using a structured observation protocol and began analysis of the resulting data. Next steps include collecting registrar's data about students on probation, interviewing advisors, and conducting surveys and focus groups for faculty and students.

RESEARCH ACTIVITIES BY CRLT IN ENGINEERING STAFF

Title and Project Team	Project Description and Activities
<p>SCREENCASTS TO INCREASE STUDENT LEARNING</p> <p>Project team: Tershia Pinder-Grover, Joanna Mirecki-Millunchick (Materials Science and Engineering), and one Michigan State University graduate student</p>	<ul style="list-style-type: none">● This project involves studying the value and impact of screencasts (i.e., digital screen captures with real-time audio commentary) in the large-lecture environment. Through the lens of Expectancy-Value Theory, the team is using a combination of quantitative and case study analyses to examine how and why students use these resources, study students' perceptions of the helpfulness of screencasts, and explore the relationship between screencast use and performance on particular exam questions.
<p>ASSESSING AND TEACHING INNOVATION</p> <p>Leadership team: Cynthia Finelli, Cindy Atman (University of Washington), Ann McKenna (Arizona State University), Cristina Pomales (University of Puerto Rico), and Lisa Lattuca (Pennsylvania State University)</p>	<ul style="list-style-type: none">● CRLT in Engineering staff led a major effort to write and submit a \$10M <i>NSF Center for Engineering Innovators</i> proposal. Though not funded, the project would have:<ul style="list-style-type: none">▪ Brought together over 75 individuals – including the PIs, research team, consultants, support staff, constituent groups, and External Advisory Board – who collectively understand the innovation ecosystem from all perspectives.▪ Gathered pilot data from over 300 engineering undergraduates and faculty, assessment data from over 2,500 individuals, and Student Innovation Portfolios from almost 400 students in order to understand the impacts of different globally- and socially-relevant innovation experiences.▪ Coordinated professional development initiatives targeted to reach over 550 faculty, future faculty, faculty developers, and administrators.▪ Impacted nearly 220,000 engineering undergraduates across the U.S., enabling them to bring the attributes of innovation to the myriad careers upon which they embark.
<p>THE CHALLENGE OF TRANSITIONING FROM AN ENGINEERING CAREER TO GRADUATE SCHOOL</p> <p>Project team: Shanna Daly and Diane Peters (postdoctoral research fellow, Mechanical Engineering)</p>	<ul style="list-style-type: none">● This project explores the experiences of returning STEM graduate students (i.e., those who have worked after their undergraduate degree for at least five years) by investigating their decision-making processes; the guidance they seek when considering graduate education; academic, personal, and social issues they face in returning; and success strategies that enable them to persist and succeed in graduate school.● The team completed ten in-depth interviews and analyzed the data. Next steps include an expansion to understand unique perspectives of returners and identify ways to leverage their role in developing innovations.
<p>CREATIVE PROCESS PEDAGOGY</p> <p>Project team: Shanna Daly, Colleen Seifert (Psychology), and eight U-M undergraduate students</p>	<ul style="list-style-type: none">● This research seeks to examine and compare “best practices” for creative development embedded in courses across the university.● The team developed and conducted an online survey, completed 20 classroom case studies, and submitted an NSF proposal to expand the work by conducting more case studies and identifying gaps in creative opportunities for engineering students.

RESEARCH ACTIVITIES BY CRLT IN ENGINEERING STAFF

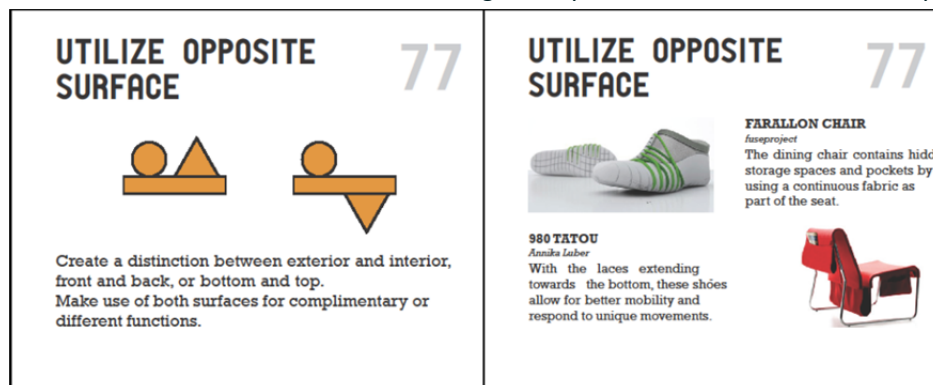
Title and Project Team

Project Description and Activities

DESIGN HEURISTICS: CARDS TO PROMPT CREATIVE DESIGNS

Project team: Shanna Daly, Seda Yilmaz (Iowa State University), Colleen Seifert (Psychology), Richard Gonzalez (Psychology), and two U-M undergraduate students

- This work involves studying innovative products and expert designers to understand strategies for successful design and developing a set of cards (i.e., design heuristics) to describe the strategies. Each card includes a description of the strategy/heuristic, an abstract image depicting the application of the heuristic, and two examples that show how the heuristic is evident in existing consumer products.
- The team has begun to validate the efficacy of the heuristics on improving the design ability of first-year engineering and second-year art and design students. The team submitted an NSF proposal to further explore the impact of the cards on other engineering and non-engineering students at U-M and at additional institutions. The team is looking for ways to make the cards more widely-available.



OPPORTUNITIES FOR CREATIVE DESIGN IN *ENG 100*

Project team: Shanna Daly, Harvey Bell (Undergraduate Engineering), Gail Hohner (Multidisciplinary Design), and Brian Gilchrist (Electrical Engineering and Computer Engineering)

- This research seeks to explore the perceptions of novice engineering students related to creative opportunities that exist within their *ENG 100* course projects. This includes an analysis of how design tasks are structured, how students perceive the structure of the tasks (in terms of the creative engineering design opportunities in their projects), and the relationship between the structure and student perceptions.

DESIGN ACROSS DISCIPLINES

Project team: Shanna Daly, Robin Adams (Purdue University), Llewellyn Mann (Swinburne University, Australia), and Gloria Dall'Alba (University of Queensland, Australia)

- The research is focused on critical differences in the way designers from within and outside engineering understand the design process and how that impacts their approaches to and progression through design work.
- The team compared its findings to results of a complimentary study and applied a new theoretical lens.

RESEARCH GRANTS SUBMITTED

1. Daly, S.R., Gonzalez, R., & Seifert, C. M. Integrating design heuristics into engineering education as a pedagogy for ideation. *NSF Transforming Undergraduate Education in STEM (TUES) Program*. Proposal #1140256, \$199,859, pending.
2. Daly, S.R., & Seifert, C. M. Using cross-disciplinary pedagogy to build creative skills in engineering students. *NSF Transforming Undergraduate Education in STEM (TUES) Program*. Proposal #1140235, \$199,920, pending.
3. Finelli, C. J. Collaborative Research: The SEED-PA. A practical instrument for assessing individual ethics initiatives. *NSF Transforming Undergraduate Education in STEM (TUES) Program*. Proposal #1140175, \$86,656, pending.
4. Finelli, C. J., Atman, C. J., Lattuca, L. R., McKenna, A. F., & Pomales, C. The Center for Engineering Innovation: Benefiting society from opportunity to market. *NSF ENG-STEP Center Program*. Proposal #1125121, \$10,000,000, not funded.
5. Mirecki-Millunchick, J. (Pinder-Grover listed as senior personnel). Using peer review to bolster student competency in technical communications. *NSF Research Initiation Grant for Engineering Education (RIGEE) Program*. \$150,000, not funded.

REFEREED JOURNAL PUBLICATIONS (OR EQUIVALENT) IN PRINT OR ACCEPTED

1. Adams, R. S., Daly, S. R., Mann, L., & Dall'Allba, G. (2011, in press). Being a professional: Three lenses on design thinking, acting, and being. *Design Studies*.
2. 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.
3. Daly, S. R., Adams, R. S., & Bodner, G. M. (2012, in press). What does it mean to design? A qualitative investigation of design professionals' experiences. *Journal of Engineering Education*.
4. Daly, S. R., Christian, J., Yilmaz, S., Seifert, C. M., & Gonzalez, R. (2012, in press). Assessing design heuristics in idea generation within an introductory engineering design course. *International Journal of Engineering Education*.
5. Finelli, C. J., Bergom, I., & Mesa, V. (2011). *Student teams in the engineering classroom and beyond: Setting up students for success*. Occasional Paper 29. Ann Arbor, MI: Center for Research on Learning and Teaching, U-M.
6. Finelli, C. J., Pinder-Grover, T., & Wright, M. C. (2011, in press). 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*. Sterling VA: Stylus Publishing.
7. 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.
8. Meizlish, D. M., Pinder-Grover, T., & Wright, M. C. (2011, in press). Effective use of graduate peer teaching consultants: Recruitment, training, supervision, and evaluation. In K. Brinko (Ed.), *Practically Speaking*. Stillwater, OK: New Forums Press. In press.
9. Pinder-Grover, T., Meizlish, D.M., & Wright, M. (2011, in press). Graduate Peer Teaching Consultants: Expanding the Center's Reach. In C. Cook (Eds.) *Advancing the Culture of Teaching on Campus: How a Teaching Center Can Make a Difference*. Stylus Publishing: Sterling, VA.
10. Pinder-Grover, T., Green, K., & Mirecki-Millunchick, J. (2011, Winter). 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.
11. Pinder-Grover, T., Milkova, S., & Hershock, C. (2011, in press). Training TAs as consultants at the University of Michigan: Workshop series for peer mentors. In K. Brinko (Ed.), *Practically speaking*. Stillwater, OK: New Forums Press.
12. 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.

REFEREED CONFERENCE PROCEEDINGS

1. Bielby, R. M., Harding, T. S., Carpenter, D. D., Finelli, C. J., Sutkus, J. A., Burt, B. A., Ra, E., & Holsapple, M. A. (2011). *Impact of different curricular approaches to ethics instruction on ethical reasoning ability*. Accepted for presentation at the 2011 ASEE Annual Conference & Exposition, Vancouver, Canada.
2. Burt, B., Carpenter, D. D., Finelli, C. J., Harding, T. S., Sutkus, J. A., Holsapple, M. A., Bielby, R. M., & Ra, E. (2011). *Outcomes of engaging engineering undergraduates in co-curricular experiences*. Accepted for presentation at the 2011 ASEE Annual Conference & Exposition, Vancouver, Canada.
3. Carpenter, D. D., Finelli, C. J., Holsapple, M. A., Bielby, R. M., Burt, B. A., Sutkus, J. A., & Harding, T. S. (2011). *Assessing the ethical development of engineering undergraduates in the United States*. Accepted for presentation at the 2011 International Research in Engineering Education Symposium, Madrid, Spain.
4. Daly, S. R., Bell, A., Gilchrist, B., Hohner, G., & Holloway, J. (2011). *Making a college-level multidisciplinary design program effective and understanding the outcomes*. Accepted for presentation at the 2011 ASEE Annual Conference & Exposition, Vancouver, Canada.
5. Daly, S. R., Christian, J., Yilmaz, S., Seifert, C. M., & Gonzalez, R. (2011). *Teaching design ideation*. Accepted for presentation at the 2011 ASEE Annual Conference & Exposition, Vancouver, Canada.
6. Finelli, C. J., & Daly, S. R. (2011). *Teaching practices of engineering faculty: Self-reported behavior and actual practice*. Accepted for presentation at the 2011 International Research in Engineering Education Symposium, Madrid, Spain.
7. Finelli, C. J., Meadows, L. A., Lorch, D., Davis, C.-S., & Meadows, G. (2010, June). Are we really “Crossing the Boundary”? Assessing a novel integrated math/science course. *Proceedings of the 2010 ASEE Annual Conference & Exposition*, Louisville, KY.
8. Holsapple, M. A., Carpenter, D. D., Sutkus, J. A., Finelli, C. J., Walczak, K., & Harding, T. S. (2010, June). Understanding the differences between faculty and administrator goals and students’ experiences with ethics education. *Proceedings of the 2010 ASEE Annual Conference & Exposition*, Louisville, KY.
9. Holsapple, M. A., Sutkus, J., Finelli, C. J., Carpenter, D. D., Burt, B. A., Ra, E., Harding, T. S., & Bielby, R. M. (2011). *We can’t get no satisfaction!: The relationship between students’ ethical reasoning and their satisfaction with engineering ethics education*. Accepted for presentation at the 2011 ASEE Annual Conference & Exposition, Vancouver, Canada.
10. Ohland, M. W., Bullard, L. G., Felder, R. M., Finelli, C. J., Layton, R. A., Loughry, M. L., Pomeranz, H. R., Schmucker, D. G., & Woehr, D. J. (2010, Aug.). Comprehensive Assessment of Team Member Effectiveness: A behaviorally anchored rating scale. *Proceedings of the 2010 Academy of Management Annual Meeting*, Montreal, Canada.
11. 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. (2010, Aug.). *The Comprehensive Assessment of Team Member Effectiveness: Development of a behaviorally anchored rating scale for self and peer evaluation*. Paper accepted for presentation at the 2010 Academy of Management Annual Meeting, Montreal, Canada.
12. Peters, D., & Daly, S. R. (2011). *The challenge of returning: Transitioning from an engineering career to graduate school*. Accepted for presentation at the 2011 ASEE Annual Conference & Exposition, Vancouver, Canada.
13. Pinder-Grover, T. & Groscurth, C. (2010, June). Perceptions of Millennial student learning: The future faculty perspective. *Proceedings of the 2010 ASEE Annual Conference & Exposition*, Louisville, KY.
14. Visco, D., Schaefer, D., Utschig, T. T., Mohsen, J. P., Fortenberry, N. L., Prince, M., & Finelli, C. J. (2010, June). Preparing for participation in SPEED: An ASEE initiative for a nationally recognized development program for engineering educators. *Proceedings of the ASEE 2010 Annual Conference & Exposition*, Louisville, KY. (ASEE Professional Interest Council V Best Paper Award)
15. Walczak, K., Finelli, C. J., Holsapple, M. A., Sutkus, J. A., Harding, T. S., & Carpenter, D. D. (2010, June). Institutional obstacles to integrating ethics into the curriculum and strategies for overcoming them. *Proceedings of the 2010 ASEE Annual Conference & Exposition*, Louisville, KY.

16. Yilmaz, S., Daly, S. R., Seifert, C. M., & Gonzalez, R. (2010, Sept). Design heuristics in ideation across engineering and industrial design domains. *Proceedings of the 12th International Conference on Engineering and Product Design Education*, Trondheim, Norway.
17. Yilmaz, S., Daly, S. R., Seifert, C. M., & Gonzalez, R. (2010, July). A comparison of cognitive heuristics use between engineers and industrial designers. *Proceedings of the 4th International Conference on Design Computing and Cognition conference*, Stuttgart, Germany. (Best Design Cognition Best Paper Award)

POSTER PRESENTATIONS

1. Bielby, R. M., Finelli, C. J., Harding, T. S., Carpenter, D. D., Sutkus, J. A., Burt, B. A., Ra, E., & Holsapple, M. A. (2011, Feb). *Impact of different curricular approaches to ethics*. Poster presented at the U-M CRLT in Engineering Fifth Annual Research and Scholarship in Engineering Education Poster Session, Ann Arbor, MI.
2. Burt, B. A., Carpenter, D. D., Finelli, C. J., Harding, T. S., Sutkus, J. A., Holsapple, M. A., Bielby, R. M., & Ra, E. (2011, Feb). *Outcomes of engaging engineering undergraduates in co-curricular experiences*. Poster presented at the U-M CRLT in Engineering Fifth Annual Research and Scholarship in Engineering Education Poster Session, Ann Arbor, MI.
3. Finelli, C. J., Carpenter, D. D., & Harding, T. S. (2011, Feb). *The Survey of Engineering Ethical Decision-Making: Developing measures of engineering students' positive ethical behavior*. Poster presented at the NSF Engineering Education Centers Awardees Conference, Reston, VA.
4. Green K., Pinder-Grover, T. & Mirecki-Millunchick, J. (2011, Feb). *The efficacy of screencasts to address the diverse academic needs of students in a large lecture course*. Poster presented at the Fifth Annual Research and Scholarship in Engineering Education Poster Session. Ann Arbor, MI.
5. Holsapple, M. A., Sutkus, J. A., Finelli, C. J., Carpenter, D. D., Burt, B. A., Ra, E., Harding, T. S., & Bielby, R. M. (2011, Feb). *We can't get no satisfaction! Ethical reasoning and satisfaction with ethics education*. Poster presented at the U-M CRLT in Engineering Fifth Annual Research and Scholarship in Engineering Education Poster Session, Ann Arbor, MI.
6. Peters, D. & Daly, S. R. (2011, Feb). *The challenge of returning: Transitioning from an engineering career to graduate school*. Poster presented at the U-M CRLT in Engineering Fifth Annual Research and Scholarship in Engineering Education Poster Session, Ann Arbor, MI.
7. Ra, E., Finelli, C. J., Holsapple, M. A., Bielby, R. M., Burt, B. A., Carpenter, D. D., Harding, T. S., & Sutkus, J. A. (2011, Feb). *Relationships between engineering students' curricular and co-curricular experiences and their ethical development*. Poster presented at the U-M CRLT in Engineering Fifth Annual Research and Scholarship in Engineering Education Poster Session, Ann Arbor, MI.

CRLT IN ENGINEERING STAFF

During 2010–2011, Cynthia Finelli, Tershia Pinder-Grover, and Shanna Daly served as primary professional staff of CRLT in Engineering. Amy Wester also supported CRLT in Engineering's activities. Their biographies are listed here. Additional programming and consultations were provided by staff from the main CRLT office including Constance Cook, Crisca Bierwert, Chad Hershock, Matthew Kaplan, Mary Wright, and Erping Zhu. Program support was provided by Danielle Dorsette, Pam Fisher, Amy Hamermesh, and Jeri Hollister.

CYNTHIA FINELLI, DIRECTOR OF CRLT IN ENGINEERING AND RESEARCH ASSOCIATE PROFESSOR



Dr. Cynthia Finelli earned B.S.E.E., M.S.E.E., and Ph.D. degrees from U-M in 1988, 1989, and 1993, respectively. Prior to joining CRLT in April 2003, she was the Richard L. Terrell Professor of Excellence in Teaching, founding director of the Center for Excellence in Teaching and Learning, and associate professor of electrical engineering at Kettering University. Her current research interests include evaluating methods to improve teaching, studying faculty motivation to change classroom practices, and exploring ethical decision-making in engineering students. Dr. Finelli was co-editor for a special issue of the *International Journal of Engineering Education* on applications of engineering education research, is past Chair of the Educational Research and Methods Division of the American Society of Engineering Education, and holds an appointment as research associate professor in engineering education at U-M.

TERSZIA PINDER-GROVER, ASSISTANT DIRECTOR OF CRLT IN ENGINEERING



Dr. Tershia Pinder-Grover earned a B.S. degree in Fire Protection Engineering from the University of Maryland in 1999 and M.S. and Ph.D. degrees in Mechanical Engineering from U-M in 2002 and 2006, respectively. She joined CRLT in August 2005, where she coordinates initiatives for engineering GSIs, develops workshops and seminars, and consults with faculty and graduate students on a variety of pedagogical topics. Her current research interests include examining the effect of instructional technology on student learning and performance and assessing the impact of peer mentoring programs for GSIs.

SHANNA DALY, INSTRUCTIONAL CONSULTANT FOR CRLT IN ENGINEERING AND ASSISTANT RESEARCH SCIENTIST



Dr. Shanna Daly earned a B.E. in Chemical Engineering from the University of Dayton in 2003, and an M.S. in Chemistry and a Ph.D. in Engineering Education from Purdue University, in 2006 and 2008, respectively. She received the Apprentice Faculty Grant Award from the Educational Research Methods Division of ASEE. Her research focuses on the investigation of design ideation, innovation practices, and creative processes as well as the translation of research to practice in the form of pedagogy, curriculum development, and faculty support.

AMY WESTER, ASSISTANT FOR GRADUATE STUDENT INITIATIVES



Amy Wester earned B.S. degrees in Computer Science and System Dynamics from Worcester Polytechnic Institute in 2000. She earned an M.S. degree in Computer Science in 2005 and an M.A. degree in Education in 2010 from U-M. She currently assists in coordinating initiatives for engineering GSIs and supports the Engineering Teaching Consultants program.

