



Frequently Asked Questions Engineering Education Research Faculty Search

October, 2015

The College of Engineering (CoE) at University of Michigan (UM) has long supported research and scholarship in engineering education, and it is committed to hiring a group of tenured and tenure-track faculty members to conduct rigorous Engineering Education Research (EER). The EER faculty members hired through this open-rank search will be appointed in engineering departments throughout CoE, and this community of scholars will provide leadership in the development of a new EER Ph.D. program at UM. In addition to establishing a thriving research program in EER, which includes advising graduate and undergraduate student researchers, EER faculty members will teach in both their engineering discipline and in the EER Ph.D. program, and they will provide service in support of the ongoing mission of their engineering department. Here we list several frequently asked questions about the search process and provide answers for them.

What are the benefits of a model for hiring EER faculty who are appointed in an engineering department?

Having EER faculty embedded in engineering departments and contributing as valuable colleagues in these departments will allow greater visibility of the EER field, more collaborations with faculty members throughout CoE and UM, and easier access to engineering courses that might serve as a research laboratory. Further, being appointed in engineering departments aligns with the standard CoE promotion and tenure process, and it will allow more widespread acceptance by traditional engineering faculty members.

What is the nature of the search committee?

The EER Faculty Search Committee comprises engineering and education faculty members who have engaged in rigorous EER, as well as engineering faculty members from traditional disciplines who are familiar with the EER field. The search committee is in frequent communication with engineering faculty members and administrators about EER. For example, in addition to meetings with department chairs to discuss the EER initiative, the search committee has been disseminating the "Fast Facts" document (reproduced at the end of this document). Besides this College-wide search committee, each engineering department has its own search, and these committees will work together to identify the best candidates for the positions.

To what degree do my application materials need to explain EER?

The search committee is actively engaged in informing non-EER faculty members about the field. As such, candidates are not expected to have to explain what EER is to the departments. However, application materials should briefly explain how the candidate defines EER and should identify the way his/her research would be beneficial to a traditional engineering department.

What is the focus of the research areas you are seeking?

We have no predefined set of research areas in mind for these positions, and the ultimate range of research areas embodied by successful candidates will likely be broad and varied. In preparing an application, candidates should comment on the advantages that UM, CoE, and engineering departments may present for conducting research.

What if I don't have three EER publications required for the application?

The most successful candidates for these positions will have demonstrated an ability to conduct EER. For many candidates, this will be through completion of a research project from conception through publication and dissemination as journal manuscripts. As an alternative to submitting publications, applicants for assistant professor positions may provide polished dissertation chapters, completed conference papers, or draft manuscripts that have or will be submitted.

How will my department home be decided?

Although the candidate is asked to indicate relevant departments and must have adequate expertise to demonstrate teaching excellence within the engineering department, the faculty member's final appointment may not necessarily be in an immediately obvious department. The match will involve a series of conversations between the candidate, search committee, College administration, department chair, and department faculty.

What is the overall culture towards EER at UM?

Many faculty members in CoE are interested in and supportive of EER. A large group of CoE professors has engaged in scholarly explorations of their classroom innovations (Scholarship of Teaching and Learning, SOTL), and a few have collaborated on EER projects. There is a healthy and dynamic community among the faculty and a sense of enthusiasm for this initiative. The CoE administration is very supportive of EER, wants to see it flourish at UM, and is committed to establishing UM as a national and international leader in EER.

What is the climate in and how receptive are the different departments toward EER?

The two departments that already have hired EER faculty (EECS and ME) have both been receptive towards the initiative, and efforts to inform faculty about the field of EER are underway. Our CoE administration and the existing EER faculty are committed to helping faculty in traditional disciplines learn about EER and to creating a culture of success for the community of EER faculty.

What is the mechanism for building community amongst the EER faculty?

Even before this initiative, the Center for Research on Learning and Teaching in Engineering (CRLT-Engin) has coordinated multiple activities to support a growing community of faculty and graduate students engaged SOTL and in more rigorous EER. These events include the Research and Scholarship in Engineering Education Poster Fair (entering its tenth year), networking lunches to discuss research projects, and learning communities for SOTL and EER. Community development will continue to grow as new EER faculty members join the College and will likely include a shared seminar series, collaborative research initiatives, and regular faculty and graduate student gatherings.

What will be the nature of the start-up package for EER faculty?

The start up package will be consistent with any competitive faculty appointment at UM. As negotiated with the engineering department, it will likely include summer salary, support for graduate students, travel funds, equipment and materials, and related items.

Where and how can I recruit students for my research activities?

We expect to launch a College-wide EER PhD program to which students will apply beginning Fall 2018, and the EER faculty will recruit graduate students from among these applicants. Until that program begins, graduate students may come from departments in CoE or other disciplines; e.g., higher education, design science, etc. Some students have already expressed an interest in EER by pursuing the Rackham Certificate in Engineering Education Research. The Office of the Associate Dean for Graduate Education in CoE may be able to provide additional assistance for recruiting students.

What is the promotion/tenure process for EER faculty?

EER faculty members will follow the standard process for promotion and tenure in CoE. Department promotion and tenure committees, working with other EER faculty members, will assess an individual's progress towards establishing an intellectual identity in the EER field using various figures of merit. These metrics include research impact, Ph.D. students graduated, classroom teaching, research funding, and comments in letters from experts in the field.

What if I have more questions?

Candidates are encouraged to email the chair of the search committee, Cindy Finelli (cfinelli@umich.edu)



Fast Facts: Engineering Education Research

Dr. Cindy Finelli and Dr. Shanna Daly
Fall 2014

Engineering Education Research (EER) is a rigorous, interdisciplinary field which is distinct from other engineering disciplines. Scholars in EER focus on and apply research methods from education, learning sciences, and social-behavioral sciences to address a variety of issues pertaining to teaching and learning in engineering. EER uses research processes similar to those used in traditional engineering disciplines, but it relies on different (equally rigorous) methods and mechanisms to achieve and measure impact in the field.

Structures and Criteria for Success in EER

As in other engineering disciplines, there are established ways to evaluate success in the field of EER. The structures to evaluate contributions to the field of EER include:

- *Academic recognition.* Nationally and internationally, there are both full faculty appointments in EER and organizational units for scholarship in the discipline. Graduates with an EER degree have frequently been hired as tenure-track faculty members in departments of engineering education and in technical engineering departments.
- *Research journals.* The Journal of Engineering Education is the field's leading publication. It has an impact factor of 2.7, and it focuses exclusively on EER. The mission of several other journals (e.g., European Journal of Engineering Education, IEEE Transactions on Education, and International Journal of Engineering Education) also encompasses EER, and EER scholars publish in journals related to higher education (e.g., Research in Higher Education and Journal of the Learning Sciences) and related to their specific research foci (e.g., Journal of Minorities in Science and Engineering, Ethics & Behavior, and Design Studies).
- *Professional associations and research conferences.* Several national and international professional associations focus on EER (e.g., American Society of Engineering Education (ASEE), Australasian Association for Engineering Education, and European Society for the Engineering Education), and they hold annual conferences with peer-reviewed proceedings. The Research on Engineering Education Symposium and the Frontiers in Education Conference also facilitate periodic gatherings of researchers in the field, and EER scholars present at conferences related to higher education (e.g., annual conference of the American Education Research Association) and related to their specific research foci (e.g., International Conference on Engineering Design).
- *Funding opportunities and honors.* Peer-reviewed extramural support is available for researchers in the field, and the National Science Foundation is the primary funder of EER through several dedicated programs in both the Education and Human Resources Directorate and the Engineering Directorate. Disciplinary honors for EER scholars include fellow grade status in ASEE, the Wickenden Award for the best paper published annually in the Journal of Engineering Education, the Outstanding Research Publication Award by Division I (Education in the Professions) of the American Educational Research Association, and the ASEE Educational Research and Methods Division's Apprentice Faculty Grant Award.

The National Research Council's "six guiding principles for scientific inquiry" form criteria by which rigorous EER contributions can be judged. These principles include:

1. Pose significant questions that can be investigated empirically;
2. Link research to relevant theory;
3. Use methods that permit direct investigation of the question(s);
4. Provide an explicit, coherent chain of reasoning;
5. Replicate and generalize *across* studies; and
6. Disclose research to encourage professional scrutiny and critique.

Thus, rather than applying structures or criteria of other engineering disciplines, evaluation of EER can be based on discipline-specific methods that are well-established and well-accepted in the field.

Research Topics in EER

EER research topics are wide ranging, and they address all levels in the engineering ecosystem from pre-K to professional practice. Research questions ask *how is engineering best learned, taught, and practiced; how do external factors impact choice and success in engineering*; and more. Other examples of EER research questions include:

- How do elementary school science and engineering programs impact young students' interest in engineering?
- What support structures are most important for underrepresented minority student success in engineering graduate programs, and how do those vary from what is commonly available?
- Why do many students resist active learning pedagogies, and how can instructors best overcome that resistance?
- What are the most successful flipped classroom designs to support students' self-directed learning?
- How is engineering identity impacted by college experiences, and how does it differ by race, gender, etc.?
- How can an engineering students' motivation or self-efficacy be measured?
- What differentiates novice and expert design approaches?
- How do practicing engineers develop common ground when pursuing interdisciplinary collaborations?

Challenges in Understanding EER

Traditional engineering researchers face common challenges in understanding (and learning) EER. For instance:

- Because EER researchers often come from the discipline of engineering (rather than the discipline of education), the concepts and language of educational theory and research are new and unfamiliar, and these can take years to learn.
- Theoretical frameworks are crucial for rigorous EER, and it can be challenging to find and understand frameworks that align with research goals and methods.
- Measurement techniques and research methods used in EER are difficult to learn; they include non-controllable studies with human subjects, mixed methods approaches, qualitative and ethnographic research, and non-generalizable quantitative approaches. Operationalizing and measuring human behavior or other EER constructs is not trivial.
- Rigorous EER research questions are open-form “why” or “how” questions as opposed to closed-form “yes” or “no” questions, and it can be hard to formulate transferable research questions that have broad appeal. Many engineering faculty members are engaged in projects to evaluate classroom teaching practices (e.g., Scholarship of Teaching and Learning), but EER projects generally extend beyond the classroom and ask broader questions that build on and contribute to theory. Thus, there is sometimes a misconception that EER is about innovative teaching, but doing EER is not necessarily coupled with being an effective teacher.

EER and Other Forms of Teaching Scholarship

EER is the most rigorous form of scholarship that lies along the following spectrum:



- *Effective Teaching* primarily involves the use of good content and teaching methods.
- *Scholarly Teaching* involves applying good content and methods with classroom assessment and evidence gathering. It is informed by best practices, and it invites collaboration and review.
- *Scholarship of Teaching and Learning (SoTL)* involves question-asking, inquiry, and investigation, particularly about student learning. SoTL is public and open to critique, and it is in a form on which others can build.
- *Engineering Education Research* involves asking questions that frequently extend beyond student learning and include “why” and “how” questions. It is public and open to critique. In addition, EER:
 - Often happens outside an individual classroom and has far-reaching implications, contributing in a broad way to the entire educational ecosystem;
 - Can include more than research-to-practice types of projects and encompass “basic research;”
 - Requires that research questions be tied to theories of learning, pedagogy, or social theory and that results be interpreted through the lens of the theory; and
 - Utilizes rigorous methods aligned with study design.

Though EER is still evolving, it is an established engineering discipline, and scholars in EER are demonstrating multiple ways to create lasting impact. Establishing an environment in which EER can flourish by building on the successful experiences of others will result in a higher-quality education that is accessible to *all* students and will provide a national model for leadership in engineering education.



Multiple Faculty Positions Tenured or Tenure-Track, All Ranks

Engineering Education Research, the University of Michigan

The College of Engineering at the University of Michigan is committed to hiring an energetic group of tenured and tenure-track faculty members to conduct rigorous Engineering Education Research (EER). EER focuses on and applies research methods from education, learning sciences, and social-behavioral sciences to address a variety of issues pertaining to teaching and learning, college access and persistence, workforce development, and other issues critical to the success of the field of engineering.

The EER faculty members hired through this search will be appointed in engineering departments throughout the College of Engineering, and this community of faculty scholars with a national reputation in EER will provide leadership in the development of a new EER Ph.D. program at the University of Michigan. In addition to establishing a thriving research program in EER, which includes advising graduate and undergraduate student researchers, EER faculty members will teach in both their technical disciplines and in the EER Ph.D. program and will provide service in support of the ongoing mission of their technical department.

Candidates should have either: (1) a Ph.D. in Engineering Education with a minimum of a B.S. degree in an engineering discipline, or (2) a Ph.D. in engineering or a related STEM field and EER experience. Further, candidates should have scholarship and publication records appropriate to their desired ranks.

To apply, prepare a cover letter, a curriculum vitae, a 2-3 page statement of teaching (with a discussion of potential engineering department appointment), a 2-3 page statement of research, three representative EER publications, and names and contact information of three EER references. Submit these materials electronically at the following College of Engineering website: <http://apps.engin.umich.edu/eerfaculty>.

The application deadline is 12/1/15, and the anticipated start date is 9/1/16. The University of Michigan is an equal opportunity/affirmative action employer and is responsive to the needs of dual career families. The College of Engineering is especially interested in candidates who can contribute, through their research, teaching and/or service, to the diversity and excellence of the academic community. Direct questions to cfinelli@umich.edu.