Global Perspectives on Engineering Education Research (EER) and Engineering Education Innovation (EEI)

Adapted from the ASEE EER&I Networking Sessions in partnership with the Rigorous Research in Engineering Education Initiative
(DUE 0817461)
http://CLEERhub.org

Fourth International Workshop (EEI2013) – January 10, 2013 – Jeju Island, South Korea

Facilitated By

Karl A. Smith
Purdue University and University of Minnesota

Ruth A. Streveler
Purdue University


Groups, centers, departments...

- **Engineering Education Centers** — Australia: UCCEE, UNESCO International Centre for Engineering Education; Denmark: UCPBLEE, UNESCO Chair in Problem Based Learning in Engineering Education; Hong Kong: E2I, Engineering Education Innovation Center; Hong Kong University of Science and Technology; Pakistan: Center for Engineering Education Research, NUST, National University for Science and Technology; South Africa: CREE, Centre for Research in Engineering Education; U of Cape Town; Sweden: Engineering Education Research Group, Linköping U; UK: ESC, Engineering Subject Centre, Higher Education Academy; USA: CELT, Center for Engineering Learning and Teaching, U of Washington; CRLT North, Center for Research on Learning and Teaching, U of Michigan; Faculty Innovation Center, U of Texas-Austin; Engineering Learning Center, U of Wisconsin-Madison; CASEE, Center for the Advancement of Scholarship in Engineering Education; National Academy of Engineering; EEIC, Engineering Education Innovation Center, Ohio State University; CEER, Center for Engineering Education Research, Michigan State University.

- **Engineering Education Degree-granting Departments** — USA: School of Engineering Education, Purdue U; Department of Engineering Education, Virginia Tech; Department of Engineering and Science Education, Clemson U; Department of Engineering and Technology Education, Utah State U; Malaysia: Engineering Education PhD program, Universiti Teknologi Malaysia; India: National Institute for Technical Teacher Training and Research, Mexico: Universidad de las Americas, Puebla.
Groups, centers, departments...


Conferences with engineering education research presentations:
- ASEE — Annual Conference, American Society for Engineering Education, see www.asee.org
- ASEE — Annual Conference, Australasian Association for Engineering Education, see www.asee.com.au
- GCEE — Global Colloquium on Engineering Education, sponsored by ASEE and local partners where the meeting is held, see www.asee.org
- SEFI — Annual Conference, Société Européenne pour la Formation des Ingénieurs, see www.sefi.be
- REES — Research on Engineering Education Symposium, rees2009.pbwiki.com/
- SASEE — South African Society for Engineering Education,

http://tinyurl.com/engredu
# Engineering Education Research Networking Session

## Connecting and Expanding the Engineering Education Research (EER) and Engineering Education Innovation (EEI) Communities

*ASEE Headquarters Session T106D in partnership with the Rigorous Research in Engineering Education Initiative (DUE 0817461)*  
http://CLEERhub.org

**ASEE Annual Conference – June 12, 2012 – T106D – 7:00 am – 8:30 am**

**Facilitated By**

- **Karl A. Smith**  
  Purdue University and University of Minnesota

- **Ruth A. Streveler**  
  Purdue University


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<td>Introduction of session and facilitators</td>
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<tr>
<td>Brief report on status of EER &amp; EEI</td>
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<td>Update on RREE – CLEERHub.org (Collaboratory for Engineering Education Research)</td>
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<td>Update on EER – NRC DBER report</td>
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<td>Update on EEI – ASEE Innovation with Impact &amp; NAE FOEE</td>
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<td>Participant Networking</td>
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<td>Rapid introductions around guided questions – Four to five conversations in groups of 3 – as a way to meet many people</td>
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<td>Identification of &quot;intellectual neighborhoods&quot; around research and innovation questions and opportunities – individual reflection and writing</td>
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<td>Brainstorming on strategies to connect, expand, and sustain the emerging EER and EEI communities</td>
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<td>Summary of ideas for (1) local, (2) national – conferences, etc. and (3) virtual community</td>
<td>5</td>
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<tr>
<td>Individuals share reflections with the large group, facilitators sum up the session and participants complete feedback forms</td>
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</tbody>
</table>
Expanding and sustaining research capacity in engineering and technology education: Building on successful programs for faculty and graduate students

Collaborative partners: Purdue (lead), Alverno College, Colorado School of Mines, Howard University, Madison Area Technical College, National Academy of Engineering
CLEERhub.org

RIGOROUS RESEARCH ENGINEERING EDUCATION

New Programs
Research on Impact
Virtual Community

5 Short Courses
How People Learn Engineering
Curriculum Development Workshop

CLEERHUB
Collaboratory for Engineering Education Research
Objectives

- Explore available resources for your use.
- Share information about upcoming improvements.
CLEERhub’s Vision & Mission

Vision:
- To be the leader in engineering education research content and collaborative opportunities.

Mission:
- Partnering with the community to develop engaging and useful content.
- Continually improving user experience with regards to information availability, platform ease of use, and tools that enable collaboration.

What’s Available Now

Some of our most popular resources:
- Fundamentals of Engineering Education Research
- Qualitative and Quantitative Research Methods
- Exploring How People Learn Engineering

Example of a Learning Module.
What’s Coming Up

- Expanding accessibility by adopting the HTML 5 standard.
  - This enables users to access content via tablets and mobile devices.
- Self-scoring quizzes to help you gain insight into your understanding.

Self-Scoring Quizzes

- Many of our resources will have self-scoring quizzes to help you gain insight into your understanding.
I Want More Information!

Request more info from your mobile phone.

Or...
Complete the request for more information from a computer. We've shortened the URL to make it easier to write down.


Recent Reports/Initiatives

• National Research Council Discipline-Based Education Research (DBER)

• ASEE Innovation with Impact report

• NAE Engineering Education Research and Innovation Activities

Global Calls for Reform

K-12 Engineering

Research-based Transformation

Discipline-Based Education Research (DBER)

Understanding and Improving Learning in Undergraduate Science and Engineering

http://www.nap.edu/catalog.php?record_id=13362
Undergraduate Science and Engineering Education: Goals

• Provide all students with foundational knowledge and skills
• Motivate some students to complete degrees in science or engineering
• Support students who wish to pursue careers in science or engineering

Undergraduate Science and Engineering Education: Challenges and Opportunities

• Retaining students in courses and majors
• Increasing diversity
• Improving the quality of instruction
What is Discipline-Based Education Research?

- Emerging from various parent disciplines
- Investigates teaching and learning in a given discipline
- Informed by and complementary to general research on human learning and cognition

Study Charge

- Synthesize empirical research on undergraduate teaching and learning in physics, chemistry, engineering, biology, the geosciences, and astronomy.
- Examine the extent to which this research currently influences undergraduate science instruction.
- Describe the intellectual and material resources that are required to further develop DBER.
Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research

- SUSAN SINGER (Chair), Carleton College
- ROBERT BEICHNER, North Carolina State University
- STACEY LOWERY BRETZ, Miami University
- MELANIE COOPER, Clemson University
- SEAN DECATUR, Oberlin College
- JAMES FAIRWEATHER, Michigan State University
- KENNETH HELLER, University of Minnesota
- KIM KASTENS, Columbia University
- MICHAEL MARTINEZ, University of California, Irvine
- DAVID MOGK, Montana State University
- LAURA R. NOVICK, Vanderbilt University
- MARCY OSGOOD, University of New Mexico
- TIMOTHY F. SLATER, University of Wyoming
- KARL A. SMITH, University of Minnesota and Purdue University
- WILLIAM B. WOOD, University of Colorado

Structure of the Report

- Section I. Status of Discipline-Based Education Research
- Section II. Contributions of Discipline-Based Education Research
- Section III. Future Directions for Discipline-Based Education Research
Section I. Status of Discipline-Based Education Research

Status of DBER: Goals

• Understand how people learn the concepts, practices, and ways of thinking of science and engineering.
• Understand the nature and development of expertise in a discipline.
• Help to identify and measure appropriate learning objectives and instructional approaches that advance students toward those objectives.
• Contribute to the knowledge base in a way that can guide the translation of DBER findings to classroom practice.
• Identify approaches to make science and engineering education broad and inclusive.
Status of DBER: Types of Knowledge Required To Conduct DBER

• Deep disciplinary knowledge
• The nature of human thinking and learning as they relate to a discipline
• Students’ motivation to understand and apply findings of a discipline
• Research methods for investigating human thinking, motivation, and learning

Status of DBER: Conclusions

• DBER is a collection of related research fields rather than a single, unified field. (Conclusion 1)
• High-quality DBER combines expert knowledge of:
  – a science or engineering discipline,
  – learning and teaching in that discipline, and
  – the science of learning and teaching more generally.
  (Conclusion 4)
Contributions of DBER: Conceptual Understanding and Conceptual Change

• In all disciplines, undergraduate students have incorrect ideas and beliefs about fundamental concepts. (Conclusion 6)

• Students have particular difficulties with concepts that involve very large or very small temporal or spatial scales. (Conclusion 6)

• Several types of instructional strategies have been shown to promote conceptual change.
Contributions of DBER: Problem Solving and the Use of Representations

• As novices in a domain, students are challenged by important aspects of the domain that can seem easy or obvious to experts. (Conclusion 7)
• Students can be taught more expert-like problem-solving skills and strategies to improve their understanding of representations.

Contributions of DBER: Research on Effective Instruction

• Effective instruction includes a range of well-implemented, research-based approaches. (Conclusion 8)
• Involving students actively in the learning process can enhance learning more effectively than lecturing.
Section III. Future Directions for Discipline-Based Education Research

Future Directions for DBER: Translating DBER into Practice

• Available evidence suggests that DBER and related research have not yet prompted widespread changes in teaching practice among science and engineering faculty. (Conclusion 12)

• Efforts to translate DBER and related research into practice are more likely to succeed if they:
  – are consistent with research on motivating adult learners,
  – include a deliberate focus on changing faculty conceptions about teaching and learning,
  – recognize the cultural and organizational norms of the department and institution, and
  – work to address those norms that pose barriers to change in teaching practice. (Conclusion 13)
Future Directions for DBER: Recommendations for Translating DBER Into Practice

• **RECOMMENDATION:** With support from institutions, disciplinary departments, and professional societies, faculty should adopt evidence-based teaching practices.

• **RECOMMENDATION:** Institutions, disciplinary departments, and professional societies should work together to prepare current and future faculty to apply the findings of DBER and related research, and then include teaching effectiveness in evaluation processes and reward systems throughout faculty members’ careers. (Paraphrased)

Future Directions for DBER: Advancing DBER through Collaborations

• Collaborations among the fields of DBER, and among DBER scholars and scholars from related disciplines, although relatively limited, have enhanced the quality of DBER. (Conclusion 15)
Future Directions for DBER: Research Infrastructure

- Advancing DBER requires a robust infrastructure for research. (Conclusion 16)
- **RECOMMENDATION**: Science and engineering departments, professional societies, journal editors, funding agencies, and institutional leaders should:
  - clarify expectations for DBER faculty positions,
  - emphasize high-quality DBER work,
  - provide mentoring for new DBER scholars, and
  - support venues for DBER scholars to share their research findings

Future Directions for DBER: Some Key Elements of a Research Agenda

- Studies of similarities and differences among different groups of students
- Longitudinal studies
- Additional basic research in DBER
- Interdisciplinary studies of cross-cutting concepts and cognitive processes
- Additional research on the translational role of DBER
Acknowledgements

• National Science Foundation, Division of Undergraduate Education (Grant No. 0934453)

• Various volunteers:
  – Committee
  – Fifteen reviewers
  – Report Review Monitor (Susan Hanson, Clark University) and Coordinator (Adam Gamoran, University of Wisconsin-Madison)

• Commissioned paper authors

• NRC staff (Natalie Nielsen, Heidi Schweingruber, Margaret Hilton)

http://www7.nationalacademies.org/bose/DBER_Homepage.html
Emphasis on Innovation

- ASEE Innovation with Impact report
  - Excerpt from Presentation by Leah Jamieson, Dean, College of Engineering, Purdue
- NAE Engineering Education Research and Innovation Activities
  - Briefing by Beth Cady, Program Officer, Engineering Education, National Academy of Engineering

ASEE Reports - A Path Forward

Creating a Culture for Scholarly and Systematic Innovation in Engineering Education

June 2009

Creating a Culture for Scholarly and Systematic Innovation in Engineering Education

June 2012
Seven Recommendations for Innovation with Impact

Who
2. Expand collaborations.

What
3. Expand efforts to make engineering more engaging, relevant, and welcoming.

How
4. Increase, leverage, and diversify resources for engineering teaching, learning, and innovation.
5. Raise awareness of proven practices and of scholarship in engineering education.

Creating a Better Culture
To measure progress in implementing policies, practices, and infrastructure in support of scholarly and systematic innovation in engineering education:
6. Conduct periodic self-assessments in our individual institutions.
National Academy of Engineering
Engineering Education Research and Innovation Activities

Beth Cady
Program Officer, Engineering Education
ecady@nae.edu

Center for the Advancement of Scholarship on Engineering Education

- Created to foster continuous improvement
- Extensive set of resources at www.nae.edu/casee
  - Research-to-Practice documents
  - Meeting agendas and reports of CASEE projects
  - Equity-related resources
  - Videos
  - Summaries

- Please help us organize the site!
  - Search terms, categories
Real-World Engineering Education

- Sponsored by AMD
- Innovative programs infusing real-world experiences
- Final publication to be released over the summer
- Includes program description and discussion of barriers/solutions

Frontiers of Engineering Education (FOEE)

- Catalyze a vibrant community of emerging engineering education leaders
- Recognize faculty accomplishment, facilitate learning, broaden collaboration, and promote dissemination of innovative practice in engineering education
FOEE (continued)

- Attendees share their work with peers
- Speakers on topics of interest to attendees
- Speakers/Coaches provide mentoring advice
- Opportunities to network with peers and coaches

- 150 alums
- Nominations for 2012 currently open
  - Nominations from dean or NAE member
  - Applications due in July
- Symposium will be October 14-17 in Irvine, CA

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Five Major Shifts in 100 Years of Engineering Education

The author discusses the shift that has occurred, or is currently occurring, in engineering education over the past 100 years with regard to the emphasis on design, learning, and social/behavioral sciences research in the role of technology.

1. A shift from hands-on and practical emphasis to engineering science and analytical emphasis;
2. A shift to outcomes-based education and accreditation;
3. A shift to emphasizing engineering design;
4. A shift to applying education, learning, and social/behavioral sciences research;
5. A shift to integrating information, computational, and communications technology in education.
### EER & STEM Centers and Programs

- Arizona State University
- University of California-Berkeley
- Clemson University
- University of Cincinnati
- University of Georgia
- Georgia Tech
- University of Kentucky
- Linkoping University (Sweden)
- Michigan State University
- University of Michigan
- University of Minnesota
- North Carolina State University
- The Ohio State University
- Pennsylvania State University
- University of Pittsburgh
- Purdue University
- Tufts University
- Universidad de las Americas Puebla (Mexico)
- Universiti Teknologi Malaysia
- University of Texas – Austin
- Uppsala University (Sweden)
- Utah State University
- Virginia Tech
- Washington State University
- University of Washington
- Wichita State University

### Hong Kong University of Science and Technology

- Engineering Education Innovation Workshop – June 2012

- Engineering Education Centers in Korea
- Engineering Education Research at the Universiti Teknologi Malaysia
Engineering Education Centers in Korea

- Center for Innovative Engineering Education – 65 Centers
- Hub Center for Innovative Engineering Education – 6 Centers
- Center for Engineering Education Research – 1 Center
- Korea Association for Innovative Engineering Education

Universities operating the ICEE (65)

- Seoul (14): Korea, SNU, KAIST, Sungkyunkwan, Sungkyunkwan, KNUT, Yonsei, Kangwon, KONKUK, Dongguk, Hanyang, Soongsil, Gwangju, Chonnam, Chonnam
- Incheon (2): Incheon, Inha
- Gyeonggi (9): Sungkyunkwan, Ajou, Hanyang, Kyunghee, Gachon, Kyunghee, Gachon, Gachon, Gachon
- Chungnam (7): Chungnam, KSI, KSI, KSI, KSI, KSI, KSI
- Daejeon (1): Hanyang
- Jeonbuk (4): Jeonbuk, Jeonbuk, Jeonbuk, Jeonbuk
- Gwangju (4): Gwangju, Gwangju, Gwangju, Gwangju
- Chonnam (2): Chonnam, Chonnam
- Kangwon (3): Kangwon, Kangwon, Kangwon
- Chungbuk (1): KNUT
- Gyeongbuk (5): Yeungnam, Yeungnam, Yeungnam, Yeungnam, Yeungnam
- Daegu (2): KUMYUNG, KUMYUNG
- Ulsan (1): Ulsan
- Busan (5): Busan, Busan, Busan, Busan, Busan
- Gyeongsangnam (4): Gyeongsangnam, Gyeongsangnam, Gyeongsangnam, Gyeongsangnam
- Jeju (1): Jeju

*Selected in the 2nd phase
The Hub Centers for Engineering Education Innovation

* The 2nd phase (2012-2014)
6 Hub Centers, 1 Research Center

Sungkyunkwan University

Chonbuk National University

Yeungnam University

Pusan National University

Seoul National University of Science & Technology

Yonsei University

* Research Center

SKKU Hub Centers

Sungkyunkwan University

Ajou

Incheon

Kyeonghee

Inha

Hanyang (ERICA)

Kangwon

Hankyoung

Gachon

Hoseo

Seoul National University

University

Pusan National University

Yonsei University

* Research Center

Design Education Collaboration

International Collaboration

Internship Collaboration

Interdisciplinary Education Collaboration

Korea Engineering Festival Collaboration

The Hub Centers
Engineering Education Research at SKKU Hub Center

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<th>Current Topics</th>
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<td>▶ Assessment of Program Education Objectives: Competency-based Approach</td>
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<tr>
<td>▶ Assessment of Outcomes produced by Center for Innovative Engineering Education Program</td>
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<tr>
<td>▶ Implementation of Grand Challenge Tech+ Innovator (GCTI) Learning Community in SKKU</td>
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<th>Future Topics</th>
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<tr>
<td>▶ Course-embedded Assessment of Program Outcomes</td>
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PhD in Engineering Education @
Regional Centre for Engineering Education (RCEE)
Universiti Teknologi Malaysia (UTM)

Transforming engineering education through innovative evidence-based practices

FACTS ON UTM
- 10 engineering schools
- 2000 tenured academics
- 2,800+ foreign students
- Largest number of engineering alumni in Malaysia
- More than 43% enrolment at graduate levels in engineering and technology in Malaysia

Contact:
khairiyah@cheme.utm.my
http://tree.utm.my
### Thrust Research Areas in UTM

1. **Flexible learning** - mobile learning, social network, courseware development, e-learning, etc.
2. **Training** - academic staff, engineers or assistant engineers
3. **Quality Management System** – OBE, program level assessment, CQI, etc.
4. **Curriculum & Teaching and Learning** - learning of difficult concepts, understanding learners, innovative T&L, course design
5. **Engineering Problem solving** - different types of thinking, skills
6. **Course Assessment** – authentic assessment, assessment of learning, assessment of professional skills

### On-going Research

- Training of academic staff in SCL techniques, especially CL & PBL
- Intellectual development/maturity of engineering students
- Developing engineering problem-solving skills
- Mobile learning for difficult engineering contents
- The use of simulations to learn engineering concepts
- Authentic assessment in engineering courses
- Sustainable development in engineering curricula
- Learning and assessing 3-D CAD
- Program quality management system
Completed PhD Research

• A model for assessing student’s achievement in basic electronic laboratory
• Enhancement of engineering students’ problem-solving skills through cooperative problem-based learning
• Conceptual knowledge in 3D CAD assessment of mechanical engineering undergraduates conceptual understanding and relative comparison as perceived by manufacturing industries
• Self-regulated learning strategies, concept understanding and performance in statics
• An inquiry based simulation supported module to assist students’ learning of basic electric circuit
• The effectiveness of learning thermodynamics through multi-media courseware based on visualization and constructivism
• An instrument to measure ICT user-skills ability for engineering learning
• Assessment of Psychomotor skills in electronics laboratory

Events coming up in 2013

• Research in Engineering Education Symposium (late June)
• Research Symposium in Problem-based Learning (early July)
• Workshop in between the 2 symposiums?
Arizona State University: Engineering Education Doctoral Program
http://engineeringed.asu.edu

International leadership in engineering and science education through discipline-based education research, preparation of future faculty, and implementation of inclusive, evidence-based curricula

Research Focus Areas:
- Assessment and improvement of problem solving
- Relationships between STEM student motivation and learning
- Student-centered learning environments
- Equity and gender issues in STEM disciplines
- STEM identity development
- Students' academic and career development and success

http://www.clemson.edu/ese/
Drs. Donna Llewellyn and Tris Utschig, along with other CETL staff members, encourage, consult, and partner with faculty who become involved in the scholarship and assessment of teaching and learning through individual, program, or grant driven initiatives.

CETL offers a range of support for implementing engineering education research and innovation, from classroom consultations to seminars, project-based fellows programs, and retreats. CETL currently supports engineering education research efforts funded by NSF, the US Dept of Education, the Engineering Information Foundation, the Goizueta Foundation, and others.
PhD in Engineering Education @
Regional Centre for Engineering Education (RCEE)
Universiti Teknologi Malaysia (UTM)

Transforming engineering education through
innovative evidence-based practices

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Contact:
khairiyah@cheme.utm.my
http://tree.utm.my

The CEER research team includes backgrounds in engineering, other STEM areas, and education.
CEER roles:
• Funded engineering education research
• Collaborate to enhance research in STEM programs at MSU
• Promote, nurture, and encourage outcomes-based education

http://ceer.eqr.msu.edu
U. Michigan: Center for Research on Learning and Teaching in Engineering
www.engin.umich.edu/crltengin

**Programs to enable research**
- SoTL grants for faculty and graduate students
- PhD Certificate in Engineering Education Research
- Networking lunches to expand research initiatives
- Faculty learning community around large course teaching

**Ongoing research initiatives**
- Faculty motivation to adopt effective teaching practices
- Impact of screencast technology on student perceptions and performance
- Strategies for innovative design practice and their translation to education
- Ethical development of engineering undergraduates

**University of Minnesota STEM Education Center**
http://www.cehd.umn.edu/STEM/
The Ohio State University
Engineering Education Innovation Center

http://eeic.osu.edu/about

The Leonhard Center for the Enhancement of Engineering Education

Founded in 1990 with a gift from William E. Leonhard

Mission includes:

- Leading and supporting enhancements in undergraduate engineering courses and programs
- Supporting assessment, including ABET
- Leading improvements in communication courses for engineering students
- Preparing graduate and undergraduate teaching assistants
- Conducting externally funded research

Current strategic focus areas:

- Cross-national teams in capstone courses
- Integration of creative process into engineering courses
- Ethics education for first year students
- Technology-enhanced learning

For more information, contact Tom Litzinger at TAL2@PSU.EDU or visit www.engr.psu.edu/leonhardcenter/
University of Pittsburgh
http://www.engineering.pitt.edu/eerc/

GOALS
• Conduct world-class research on teaching and learning of science, engineering and technology
  • Scholarship of discovery
• Use the results of that research to continually improve instruction at UDLAP, Mexico and other Ibero-American countries to better support the learning process of our students
  • Scholarship of application, integration, and teaching
• Support the educational needs of science, engineering and technology teachers and learners at the P-12, University, and continuing professional development levels
  • Scholarship of application, integration, and teaching

• Mexican private institution of higher learning
  -- accredited in the US since 1959 by SACS

• Fall 2003
  • Center for Science, Engineering, and Technology Education
• Fall 2006
  • PhD program
• Spring 2008
  • program accredited by the National Council of Science and Technology (CONACYT) of Mexico
• Fall 2009
  • first graduate
• Fall 2010
  • ≈ 40 PhD students
**Purdue University**

https://engineering.purdue.edu/ENE/Academics/Graduate/Doctorate/index.html

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**The University of Texas at Austin**

**STEM Education**

Master’s & PhD Programs (97 students total)

**Past and Current Research**
- UTeach Engineering (NSF-MSP)
- Beyond Blackboards (NSF-ITEST)
- VaNTH (NSF-ERC)
- Teacher Training for Engineering
- IPRO - Programming Standing Up
- Adaptive Expertise in Engineering
- K-12 LEGO Robotics
- Discourse in K-12 engineering teams
- National HS Curriculum Project

**Faculty**
- David Allen (Chem Eng)
- Leema Berland (STEM-Ed)
- Richard Crawford (Mech Eng)
- Ken Diller (BioEng)
- Jill Marshall (STEM-Ed)
- Anthony Petrosino (STEM-Ed)
- Catherine Riegle-Crumb (STEM-Ed)
Engineering Education Research
Improving Education through Engineering
• Research in engineering teaching and learning, outreach, and educational technology development.
• Current projects:
  • Integrating Engineering and Literacy (IEL)
  • Design Compass: How people design

• Interactive Learning and Collaboration Environment (InterLACE)
• LEGO Robotics: Catalyzing Social Communication in Students with Autism
• W-STOMP Women in Engineering

Tufts Department of Education
Engineering Education M.S. & Ph.D. Program
• Develop research on how students (K-College) learn/engage in engineering
• Interdisciplinary thesis committee (at least 1 education and 1 engineering professor)

http://ceedu.tufts.edu/

Utah State University
http://www.engineering.usu.edu/htm/information/phd-engineering-education
Virginia Tech

http://www.enge.vt.edu/

University of Washington

http://www.hcde.washington.edu/nav-prog-advise/phd
Center for Engineering Learning and Teaching

- research findings
- research in engineering student learning
- improve engineering teaching at UW
- feedback about what works

CELT

Founded in 1998, CELT is First Campus-Based Center in U.S. to Combine Research and Faculty Development Missions.

Engineering Education Research Center

- Six faculty in College of Engineering and Architecture who focus on engineering education
- About 20 active engineering education graduate students
- Students receive engineering degrees
- Research areas include conceptual change and epistemology, human computer interactions, adoption of innovations, assessment of design skills, problem-based learning, and collective intelligence in design

http://eerc.wsu.edu/
### Engineering Education Departments and Programs (Graduate)

### Engineering/STEM Education Graduate Programs

<table>
<thead>
<tr>
<th>Institution</th>
<th>Program</th>
<th>Degree Awarded</th>
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<tbody>
<tr>
<td>[Site Name]</td>
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<tr>
<td>[University]</td>
<td>[Program Details]</td>
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[http://tinyurl.com/engedu](http://tinyurl.com/engedu)