Engineering Education Research Networking Session

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

Special Session F3B in partnership with the
Rigorous Research in Engineering Education Initiative
(DUE 0817461)
CLEERhub.org

ASEE/IEEE Frontiers in Education Conference – October 14, 2011 – F3B – 2:30 pm – 4:00 pm

Facilitated By
Karl A. Smith
Ruth A. Streveler
Qaiser Malik
Purdue University and University of Minnesota
Purdue University
Purdue University

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<th>Activity</th>
<th>Time Allocated</th>
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<tr>
<td>Introduction of session and facilitators</td>
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<td>Brief report on status of RREE project and NAE FOEE</td>
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<td>Update on CLEERHub.org (Collaboratory for Engineering Education Research)</td>
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<td>Update on EER workshops and JEE collaboration</td>
<td>5</td>
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<td>Update on EEI – NAE FOEE &amp; NSF TUES</td>
<td>10</td>
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<tr>
<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>
<td>25</td>
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<td>Identification of “intellectual neighborhoods” around research and innovation questions and opportunities – individual reflection and writing</td>
<td>5</td>
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<td>Brainstorming on strategies to connect, expand, and sustain the emerging EER and EEI communities</td>
<td>15</td>
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<td>Summary of ideas for (1) local, (2) national – conferences, etc. and (3) virtual community</td>
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<td>Individuals share reflections with the large group, facilitators sum up the session and participants complete feedback forms</td>
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Celebration of Two Major ASEE Milestones

2011 ASEE Annual Conference and Exposition
Vancouver, British Columbia · Monday, June 27, 2011

One BIG Idea; Two Perspectives

The Innovation Cycle of Educational Practice and Research

Research Evidence

Research that makes a difference... in theory and practice

Practice

The Innovation Cycle of Educational Practice and Research

which help improve

Educational Practice

identifies and motivates

Educational Research

that results in

Educational Insights

which lead to

Educational Ideas

Adapted from Duckel, Cumb, and Williams, 2006

Jamieson & Lohmann (2009)

Engineering Education Innovation
ASEE Main Plenary, 8:45 a.m. – 10:15 a.m.
Vancouver International Conference Centre, West Ballroom CD

Expected to draw over 2,000 attendees, this year’s plenary features Karl A. Smith, Cooperative Learning Professor of Engineering Education at Purdue University and Morse–Alumni Distinguished Teaching Professor & Professor of Civil Engineering at the University of Minnesota.

Smith has been at the University of Minnesota since 1972 and has been active in ASEE since he became a member in 1973. For the past five years, he has been helping start the engineering education Ph.D. program at Purdue University. He is a Fellow of the American Society for Engineering Education and past Chair of the Educational Research and Methods Division. He has worked with thousands of faculty all over the world on pedagogies of engagement, especially cooperative learning, problem-based learning, and constructive controversy.

On the occasion of the 100th anniversary of the Journal of Engineering Education and the release of ASEE’s Phase II report Creating a Culture for Scholarly and Systematic Innovation in Engineering Education (Jamieson/Lohmann report), the plenary will celebrate these milestones and demonstrate rich, mutual interdependencies between practice and inquiry into teaching and learning in engineering education. Depth and range of the plenary will energize the audience and reflects expertise and interests of conference participants. One of ASEE’s premier educators and researchers, Smith will draw upon our roots in scholarship to set the stage and weave the transitions for six highlighted topics selected for their broad appeal across established, evolving, and emerging practices in engineering education.

Video: https://secure.vimeo.com/27147996
Slides: http://www.ce.umn.edu/~smith/links.html
http://www.asee.org/conferences-and-events/conferences/annual-conference/2011/program-schedule/conference-highlights

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
Getting Started in Engineering Education Research

Fundamentals of Engineering Education Research

sponsored by the
ASEE Educational Research
and Methods Division

in partnership with
Rigorous Research in
Engineering Education Initiative
CLEERhub.org
And the Journal of Engineering Education

ASEE Annual Conference – June 20, 2010 – Session 0230

Ruth A. Streveler
Purdue University

Karl A. Smith
Purdue University and
University of Minnesota

Levels of Engineering Education Inquiry

- **Level 0** Teacher
  - Teach as taught (“distal pedagogy”)

- **Level 1** Effective Teacher
  - Teach using accepted teaching theories and practices

- **Level 2** Scholarly Teacher
  - Assesses performance and makes improvements

- **Level 3** Scholar of Teaching and Learning
  - Engages in educational experimentation, shares results

- **Level 4** Engineering Education Researcher
  - Conducts educational research, publishes archival papers

Research can be inspired by …

<table>
<thead>
<tr>
<th>Understanding</th>
<th>Use (Applied)</th>
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<tbody>
<tr>
<td>Yes</td>
<td>Pure basic research (Bohr)</td>
</tr>
<tr>
<td>No</td>
<td>Pure applied research (Edison)</td>
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Guiding Principles for Scientific Research in Education

1. **Question**: pose *significant* question that can be investigated *empirically*
2. **Theory**: link research to relevant theory
3. **Methods**: use methods that permit direct investigation of the question
4. **Reasoning**: provide coherent, explicit chain of reasoning
5. **Replicate and generalize** across studies
6. **Disclose** research to encourage professional scrutiny and critique

*National Research Council, 2002*
We have set out to trace the current landscape of engineering education research programs. The emergence of many new programs globally as well as the success of recent EER Ph.D.s and faculty provide evidence that the community is no longer marginalized but is heading toward mainstream acceptance. Exciting opportunities await us to build knowledge that will make a difference in engineering education curricula and pedagogy.


There is growing acceptance of discipline-based education as a valuable research enterprise, on the same level as research into, say, mechanical engineering or organic chemistry. Evidence of innovative ways that discipline-based education programs are taking root in higher education include the establishment of cross-disciplinary departments in science, technology, and engineering education. These departments bring together faculty whose research area is education, who can tackle large-scale problems across the curriculum in addition to discipline-specific research projects.

Emphasis on Innovation

- NSF TUES (CCLI) PI Meeting
  - TUES (Transforming Undergraduate Education in STEM)
  - Myles Boylan presentation
  - Carl Wieman presentation – White House – Office of Science and Technology Policy

- NAE Frontiers of Engineering Education (FOEE)
  - http://www.nae.edu/Activities/Projects20676/CASEE/26338/35816 FOEE.aspx
The Federal Environment for STEM Education Programs: Implications for TUES

& Some of your suggestions

Myles Boylan
Division of Undergraduate Education
National Science Foundation
CCLI PI Meeting January 28, 2011

Cyclic Model for Creating Knowledge and Improving Practices in STEM Education

New Materials and Strategies

Increase Faculty Expertise

Research on Teaching and Learning

Assess And Evaluate

Implement Innovations
Engineering Education Research Networking Session
Connecting Engineering Education Research Programs from Around the World

sponsored by the
ASEE International Division

in partnership with
Rigorous Research in Engineering Education Initiative
CLEERhub.org
And the Journal of Engineering Education

ASEE Annual Conference – June 22, 2010 – Session 2123

Facilitated By

Karl A. Smith
Purdue University and University of Minnesota

Jack Lohmann
Georgia Tech

Satish Udpa
Michigan State University

Hans Hoyer
ASEE

Ruth A. Streveler
Purdue University

Stephanie Eng
ASEE

ASEE 2010 - EER PhD Program Briefings

- Utah State University - Kurt Becker
- Purdue University - David Radcliffe & Robin Adams
- Universidad de las Americas, Puebla, Mexico - Enrique Palou
- Virginia Tech - Maura Borrego
- Universiti Teknologi Malaysia - Zaini Ujang
- Clemson University - Lisa Benson
- IIT TTTRs - India - R. Natarajan
- Arizona State University - Tirupalavanam Ganesh & Chell Roberts
- University of Washington - Cindy Atman
- Ohio State University - Lisa Abrams
- Carnegie Mellon University - Paul Steif
- University of Michigan - Cindy Finelli
- Washington State University - Denny Davis
- University of Georgia - Nadia Kellam & Joachim Walther
- Michigan State University - Jon Sticklen
- University of Colorado - Boulder - Daria Kotys-Schwartz

Session slides and links to programs posted to CLEERhub.org
Groups, centers, departments...

Engineering Education Centers — Australia: UICEE, UNESCO International Centre for Engineering Education; Denmark: UCPBLEE; UNESCO Chair in Problem Based Learning in Engineering Education; Hong Kong: E2IC, Engineering Education Innovation Center, Hong Kong University of Science and Technology; Pakistan: Center for Engineering Education Research, HUST, 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.

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

Engineering education societies...


Forums for dissemination...

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
• GCCE — 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,

Engineering Education Research Networking Session

Connecting and Expanding the Engineering Education Research Community

Special Session in partnership with the
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(DUE 0817461)
CLEERhub.org

ASEE/IEEE Frontiers in Education Conference – October 29, 2010 – F3B – 4:30 pm – 6:00 pm

Facilitated By

Karl A. Smith
Purdue University and University of Minnesota

Ruth A. Streveler
Purdue University

Qaiser Malik
Purdue University
A Celebration of the Engineering Education Research Community

Special ERM Session in partnership with the
The Journal of Engineering Education (JEE)
Rigorous Research in Engineering Education Initiative (DUE 0817461)
CLEERhub.org

ASEE Annual Conference – June 27, 2011 – M722A – 6:00 pm – 8:00 pm

Facilitated By

Karl A. Smith
Purdue University and University of Minnesota

Ruth A. Streveler
Purdue University

Jack Lohmann
Georgia Tech

Jeff Froyd
Texas A&M

Participant Networking

Engineering/ STEM Education Graduate Programs

- Arizona State University
- University of California-Berkeley
- Clemson University
- University of Cincinnati
- University of Kentucky
- Linköping University (Sweden)
- University of Minnesota
- The College of New Jersey
- Niagara University
- North Carolina State University
- Old Dominion University
- The Ohio State University
- Purdue University
- Tufts University
- Universidad de las Americas Puebla (Mexico)
- Universiti Teknologi Malaysia
- Uppsala University (Sweden)
- Utah State University
- Virginia Tech
## Participant Networking

### Engineering Education-Related Certificate Programs
- Arizona State University
- Boise State University
- Clemson University
- Michigan State University
- University of Michigan
- North Carolina State University
- Virginia Tech
- Wichita State University

### Innovative Engineering and Inter/ Cross-Disciplinary Programs
- Aalborg University (Denmark)
- Carnegie Mellon University
- North Dakota State University
- Stony Brook University
- Texas A&M University
- University of Georgia
- University of Washington

Participant Networking Activity (~25 min)

- Introductions with Guided Format
- Three (~8 min) Conversations in Groups of 2-3
  - Your Name & Organization
  - Status of EER Center or PhD Program/ Interest in EER & EEI
  - Suggestions for Starting/ Questions About Starting
  - Exchange Business Cards/ Contact Information
  - Identify “intellectual neighborhoods” around common research, organization or other questions and interests
  - Talk about ways to follow up
- Bell will ring once after 7 min and twice after 8 min
- Move to a New Group

Connecting, Expanding & Sustaining the Emerging EER Community (~10 min)

- Small Group (2-3) Brainstorming
  - Ideas for (1) local, (2) national, (3) international Community
  - Ideas for Virtual Community
  - Further Ideas
- Summarize Ideas and Record
Next Steps (~ 5 min)

- Silently reflect on your interests and plans for engineering education research
- Jot down
  - What do you plan to do next?
  - What are your longer range plans?
- Continue the conversation during the FIE conference and beyond
  - EER Networks – CLEERhub, REEN, SEFI
  - Meet again at ASEE Conference, June, 2012

Acknowledgement

- We acknowledge the National Science Foundation for funding Karl Smith and Ruth Streveler’s participation (DUE 0817461)
  - COLLABORATIVE RESEARCH: Expanding and sustaining research capacity in engineering and technology education: Building on successful programs for faculty and graduate students
- And the ASEE/IEEE Frontiers in Education Conference for hosting
Thank you!

An e-copy of this presentation will be posted to:

http://CLEERhub.org

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