Seminar on
Engineering Education Research (EER): Status of Global Efforts and Opportunities

sponsored by the
Universiti Teknologi Malaysia

in partnership with
Annals of Research in Engineering Education

Journal of Engineering Education
Rigorous Research in Engineering Education Initiative

Skudai, Malaysia – March 12, 2009

Karl A. Smith
Purdue University and University of Minnesota
Overview
What are we going to do?

We assume you are here because either you are...

• engaged in EER and already have a strong interest in the topic, or
• interested in EER and want to be more personally engaged or encourage and support others to be engaged

Focus of the seminar
• Enhance awareness of the nature of engineering educational research
• Increase familiarity with the emerging global engineering education research community

Format of the seminar
• Reflection and small-group dialogue
• Presentation
• Reflection and whole group conversation

Resources
Introduction and reflective dialogue

• Your seminar speakers

Gesture
• Individually, reflect on your engineering education research experience and interest, and reasons for your interest (~ 1 minute)

Gesture
• Introduce yourself to a person nearby and share your thoughts (~2 minutes)
Why should we care about research in engineering education?

At M.I.T., Large Lectures Are Going the Way of the Blackboard

The Massachusetts Institute of Technology has changed the way it offers some introductory classes. Prof. Gabriela Solis left a class on electricity and magnetism.

By SARAH WEINSTEIN
Published: January 12, 2009

CAMBRIDGE, Mass. — For as long as anyone can remember, introductory physics at the Massachusetts Institute of Technology was taught in a vast windowless amphitheater known by its number, 2-100.

January 13, 2009—New York Times

Reason one — Calls for evidence-based teaching practices
Reason Two: Faculty interest in higher levels of inquiry in engineering education

- **Level 0** Teacher
  - Teach as taught

- **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

Rigorous Research in Engineering Education (RREE) - Streveler & Smith

- **RREE-1**
  - Funded by National Science Foundation (NSF), 2004-2006
  - One-week summer workshop, year-long research project
  - About 150 engineering faculty participated

- **RREE-2**
  - Funded by NSF, 2008-2011, Expanding and Sustaining Research Capacity in Engineering and Technology Education
  - Five short courses, WWW enabled learning environment

- **Goals**
  - Identify engineering faculty interested in conducting engineering education research
  - Develop faculty knowledge and skills for conducting engineering education research (especially in theory and research methodology)
  - Cultivate the development of a Community of Practice of faculty conducting engineering education research
Guiding principles for scientific research in education

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
4. Provide coherent, explicit chain of **reasoning**
5. Replicate and **generalize** across studies
6. Disclose research to encourage professional **scrutiny and critique**

**Source:** Scientific Research in Education, National Research Council, 2002
The research process and reasoning

- Practical Problem
- Research Answer
- leads to
- Research Problem
- motivates
- Research Question
- informs
- Research Answer
- and helps
- Research Problem

Claim → Reason → Evidence
Warrant
Acknowledgment and Response
Research Reasoning

Research Process
Books, journals, online resources

- The Craft of Research
- Scientific Research in Education
- Journal of Engineering Education (JEE)
- Annals of Research on Engineering Education (AREE)
- See workshop presentation for additional resources
A growing global journal
8,500 subscribers, 70 countries, 5 partners

- **Founded in 1910**
  - "technical" journal/magazine for 80 years
  - mission refined in 1993 and again in 2003

- **Mission**
  - "...serve as an archival record of scholarly research in engineering education"

- **Manuscript types**
  - Research investigations
  - Research reviews

- **Six review criteria**

www.asee.org/jee

**NOTE!**
"The Relationships Between Students’ Conceptions of Learning and Their Preferences for Classroom and Laboratory Learning Environments," by Chia-Ching Ling and Chin-Chung Tsai, National Taiwan University of Science and Technology, to appear in the *Journal of Engineering Education*, April 2009
• Link journals related to engineering education
• Increase progress toward shared consensus on quality research
• Increase awareness and use of engineering education research
• Increase discussion of research and its implications

• **Resources - community recommended**
  – Annotated bibliography
  – Acronyms explained
  – Conferences, professional societies, etc.

• **Articles - education research**
  – Structured summaries
  – Reflective essays
  – Reader comments
An emerging global community

(Examples: Not an exhaustive list!)

- Engineering Teaching and Learning Centers
- Engineering Education Degree-granting Departments
- Engineering Education Societies and Organizations (logos shown)
- Engineering Education Conferences often with EER Sessions

Taiwan?
Two special global efforts specifically to build community

- “Advancing the Global Capacity for Engineering Education Research” (**AGCEER**)
  - Joint effort JEE and EJEE
  - 10 sessions at 10 international conferences

- **Research in Engineering Education Symposium (REES)**
  - Retreat-like, research-only symposium
  - 2007, Honolulu, Hawaii; 2008, Davos, Switzerland; 2009, Queensland, Australia
Reflective dialogue and whole group conversation

- Individually, reflect on the presentation and note insights, applications, questions, etc. (~ 1 minute)
- Talk with a person nearby and develop a brief list of issues and questions (~2 minutes)
- Discussion as a whole group
Thank you!

An e-copy of this presentation may be found at:
http://www.ce.umn.edu/~smith/links.html

Skudai, Malaysia – March 12, 2009

ksmith@umn.edu