

Conducting Rigorous Research in Engineering Education

The Community of Practice



Conducting Rigorous Research in Engineering Education: Creating a Community of Practice (RREE)

NSF-CCLI-ND

American Society for Engineering Education

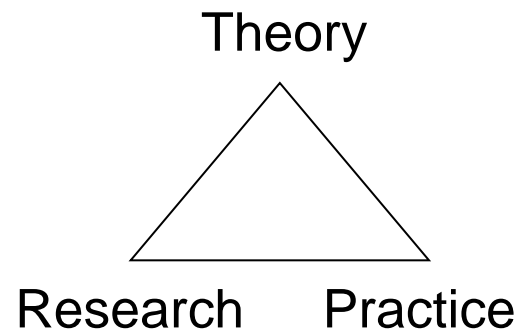
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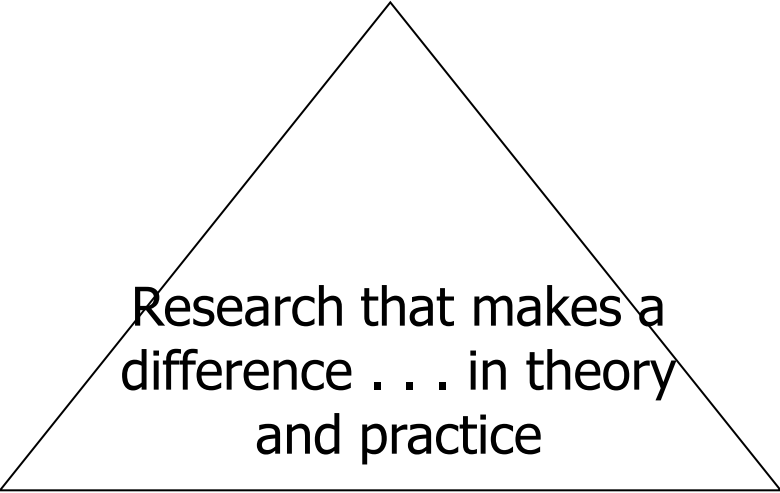
RREE Approach

- Theory – Study grounded in theory/conceptual framework
- Research – Appropriate design and methodology
- Practice – Implications for practice



RREE Approach

Theory



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

Research

Practice

Research Inspired By:

Use (Applied)

Understanding (Basic)

No

Yes

Yes

Pure basic
research
(Bohr)

Use-inspired
basic research
(Pasteur)

No

Pure applied
research
(Edison)

Stokes, Donald. 1997. Pasteur's quadrant: Basic science and technological innovation. Wash, D.C., Brookings.

Basic Features of Professional and Scholarly Work

- It requires a high level of discipline-related expertise
- It is conducted in a scholarly manner with clear goals, adequate preparation, and appropriate methodology
- The work and its results are appropriately and effectively documented and disseminated. This reporting should include a reflective critique that addresses the significance of the work, the process that was used, and what was learned.
- It has significance beyond the individual context.
- It breaks new ground or is innovative.
- It can be replicated or elaborated on.
- The work both process and product or result is reviewed and judged to be meritorious and significant by a panel of ones peers.

Bob Diamond (2002)



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

JEE Research Emphasis

January 2005



- The State of the Art and Practice of Engineering Education Research
- Guest Editors
Richard M. Felder, NCSU
Sheri D. Sheppard, Stanford
Karl A. Smith, U of Minnesota

Journals vary considerably

All Fields (Current Volume)	Peer Reviewed?	Society Sponsored?	Research Focus?
JEE (93)	YES	YES	YES*
EJEE (29)	YES	YES	No
IJEE (20)	YES	No	No
WTE&TE (2)	YES	No	No
JSMETE (3)	YES	No	No
Focused (Discipline)			
JPIEEP (CE)	YES	YES	No
CEE (ChE)	YES	YES	No
IEEE TE (EE)	YES	YES	No
INFORMS TE (OR)	YES	YES	No
IJCELLL (Cont. Ed.)	YES	No	No
IJMEE (ME)	n/a	No	No
IJEEE (EE)	n/a	No	No

Source: Jack Lohmann

* JEE initiated a research focus January, 2003

What *JEE* expects

- Mission refined January, 2003
 - ...to serve as an archival record of scholarly research in engineering education
- Ten review criteria
 - Five focused on content and contribution
 - Five focused on composition and presentation

Content and contribution

- Appeal to a broad readership interested in engineering education
- Address important questions or propositions of lasting value
- Build upon relevant references and bodies of knowledge
- Employ appropriate educational or scientific principles and methodologies
- Present original ideas or results supported by compelling evidence

RREE & Engaged Scholarship*

1. Design the project to address a big question or problem that is grounded in reality.
2. Design the research project to be a collaborative learning community.
3. Design the study for an extended duration of time.
4. Employ multiple models and methods to study the problem.
5. Re-examine assumptions about scholarship and roles of researchers.

*Van de Ven and Johnson (2005)

Boyer, Ernest L. 1990. *Scholarship reconsidered: Priorities for the professoriate*. Princeton, NJ: The Carnegie Foundation for the Advancement of Teaching.

Diamond, R., "The Mission-Driven Faculty Reward System," in R.M. Diamond, Ed., *Field Guide to Academic Leadership*, San Francisco: Jossey-Bass, 2002

Diamond R. & Adam, B. 1993. *Recognizing faculty work: Reward systems for the year 2000*. San Francisco, CA: Jossey-Bass.

National Research Council. 2002. *Scientific research in education*. Committee on Scientific Principles in Education. Shavelson, R.J., and Towne, L., Editors. Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

Shulman, Lee S. 1999. Taking learning seriously. *Change*, 31 (4), 11-17.

Van de Ven, Andrew H. and Johnson, Paul E. 2005. Knowledge For Theory and Practice. Forthcoming in *Academy of Management Review*

Wankat, P.C., Felder, R.M., Smith, K.A. and Oreovicz, F. 2001. The scholarship of teaching and learning in engineering. In Huber, M.T & Morreale, S. (Eds.), *Disciplinary styles in the scholarship of teaching and learning: A conversation*. Also presented at American Association for Higher Education Faculty Roles & Rewards Conference, February, 2001.

Session Reflection

(Minute Paper – Index Card)

Reflect on the session:

1. What did you find most interesting, valuable or useful
2. What is one thing you that excites you about RREE?
3. What questions do you have?
4. Pace: Too slow 1 5 Too fast
5. Relevance: Little 1 . . . 5 Lots
6. Format: Ugh 1 . . . 5 Ah