

#### **Conducting Rigorous Research in Engineering Education**

The Community of Practice

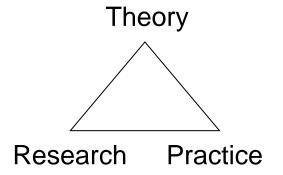


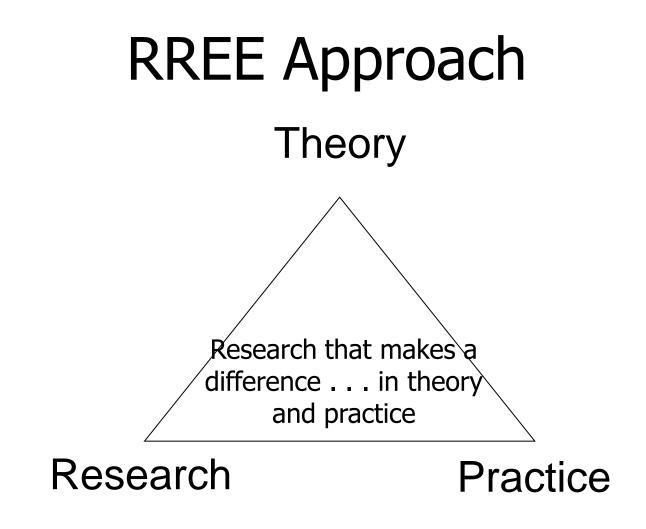
### Conducting Rigorous Research in Engineering Education: Creating a Community of Practice (RREE)

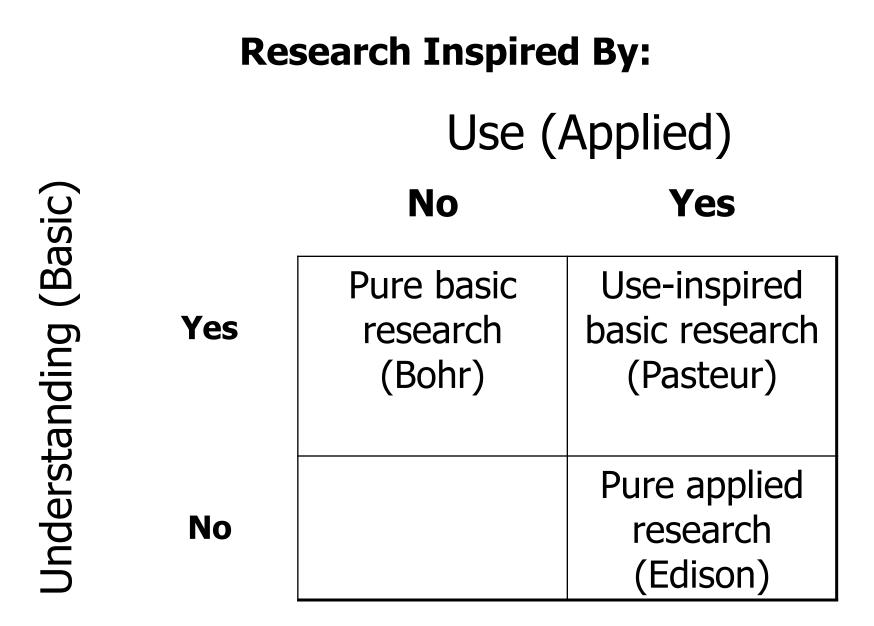
NSF-CCLI-ND American Society for Engineering Education Karl Smith & Ruth Streveler University of Minnesota & Colorado School of Mines

# **RREE** Approach

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







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 <u>significant</u> question that can be investigated <u>empirically</u>
- 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

### JEE Research Emphasis

#### January 2005

Journal of Engineer Education	on a state
Building a Community of Scholars: The Role  of the Journal of Engineering Education as a  Research Journal  Jack R-Lomman	87 Pedagogies of Engagement: Classroom-Based Practices Karl A. Smith, Sheri D. Sheppard, David W. Jahnson, and Proger J. Jahnson
7 A New Journal for a Field in Transition Richard M. Felder, Sheri B. Sheppard, and Karl A. Smith	103 Engineering Design Thinking, Teaching, and Learning Crive L. Dym. Alice M. Agogins. Orgur Eris. Damel D. Freis, and Larry J. Leffer
If Not Now, When? The Timeliness of Scholarship of the Education of Engineers Lee S. Shulman	123 The Role of the Laboratory in Undergraduate Engineering Education Lyle D. Fesel and Albert J. Rosa
T3 Assessment in Engineering Education: Evolution, Approaches and Future Collaborations Bachari M Ods, Barbara M. Moskal	151 Online Engineering Education: Learning Anywhere, Anytime John Bourne, Date Harris, and Frank Mayadas
and Ronald L. Miler <b>17</b> Research on Engineering Student Knowing: Trends and Opportunities Jenrifer Turns, Cyrithius J. Atman, Ribbin S. Adams, and Thereas Backer	<sup>16</sup> Integrated Engineering Curricula Jeffrey E Froyd and Matthew W. Ohbod 165 Quality Assurance of Engineering Education through Accreditation: The Impact of Engineering Criteria 2009 and Its Global
1 The ABET "Professional Skills" – Can They Be Taught? Can They Be Assessed? Lamy J. Shuman, May Desterfield Sacra, and Jack McGourty	Influence John W, Prados, Goorge D, Peterson, and Lea R. Lattuca 185 Becoming & Professional Engineering
57 Understanding Student Differences Richard M. Felder and Robecca Brent	Educator: A New Role for a New Era L. Dee Firls, Susan Ambrose, and Daniel Wheeler 195 Centered on Education Research
73 Diversifying the Engineering Workforce Day'E Chubin, Gary S. May, and Eleanor L. Babco	Date T. Rover

- 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

Source: Jack Lohmann

### 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

Source: Jack Lohmann

### 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

Source: Jack Lohmann

# RREE & Engaged Scholarship\*

- 1. Design the project to addresses 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 fast5.Relevance: Little 1 . . . 5 Lots6.Format: Ugh 1 . . . 5 Ah