

Building Engineering Education Research Capabilities and Communities

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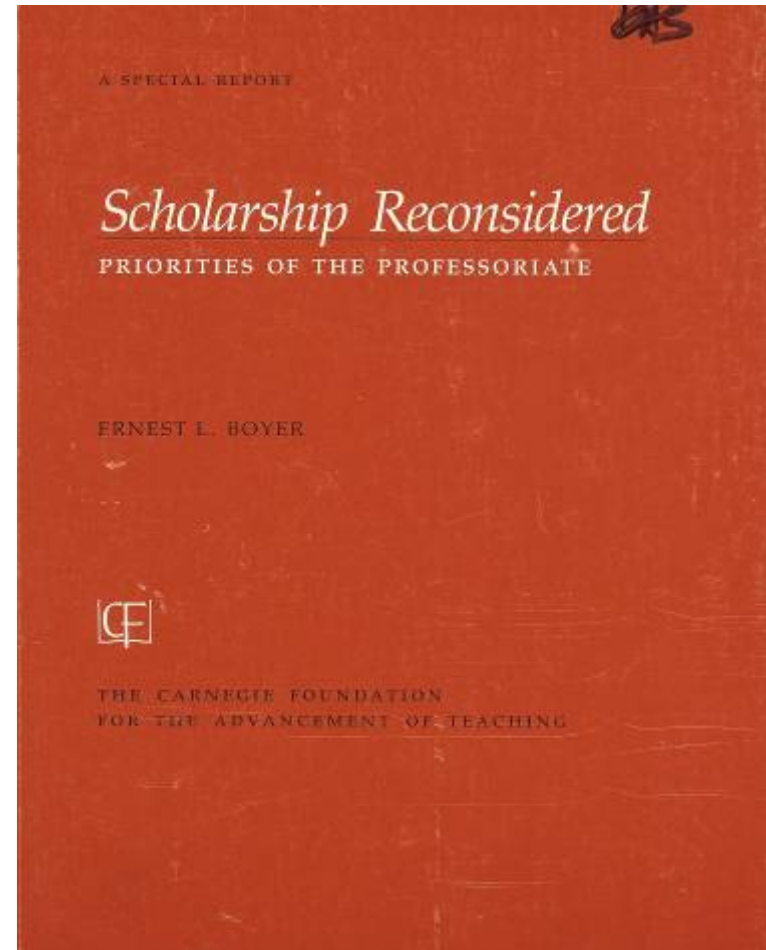
**Advancing Taiwan-US Collaborations for
Excellence in Engineering Education**

American Society for Engineering Education

June 17, 2009

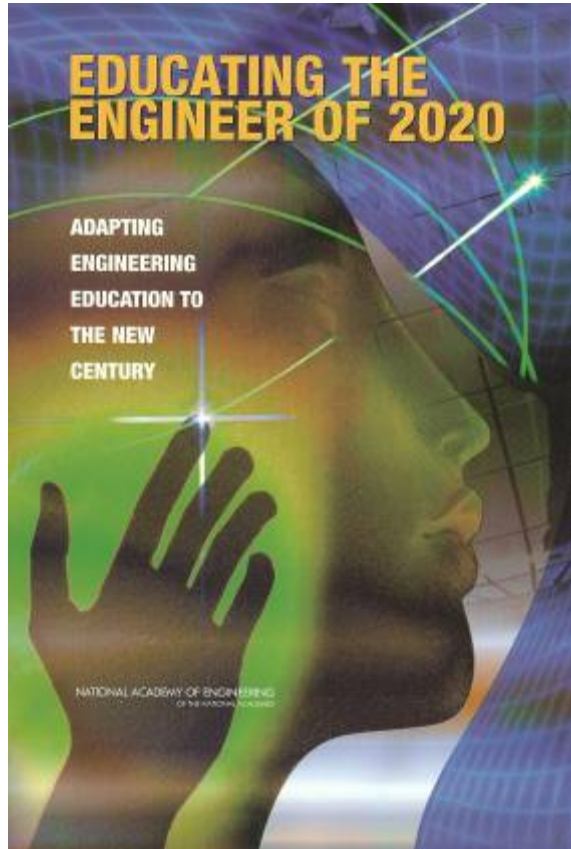
Scholarship Reconsidered: Priorities of the Professoriate Ernest L. Boyer

- The **Scholarship of Discovery**, research that increases the storehouse of new knowledge within the disciplines;
- The **Scholarship of Integration**, including efforts by faculty to explore the connectedness of knowledge within and across disciplines, and thereby bring new insights to original research;
- The **Scholarship of Application**, which leads faculty to explore how knowledge can be applied to consequential problems in service to the community and society; and
- The **Scholarship of Teaching**, which views teaching not as a routine task, but as perhaps the highest form of scholarly enterprise, involving the constant interplay of teaching and learning.



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

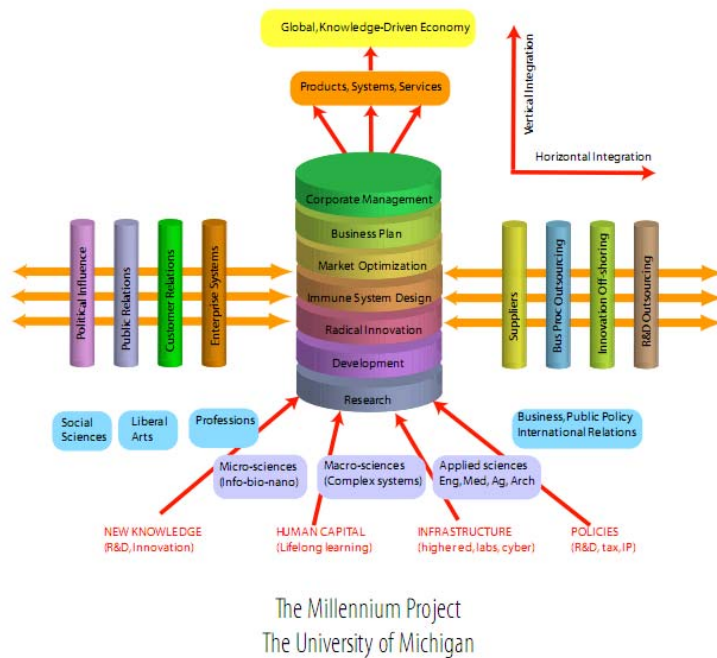
Engineering Education Research



Colleges and universities should endorse research in engineering education as a valued and rewarded activity for engineering faculty and should develop new standards for faculty qualifications.

Engineering for a Changing World

A Roadmap to the Future of
Engineering Practice, Research, and Education



...objectives for engineering practice, research, and education:

To adopt a systemic, research-based approach to innovation and continuous improvement of engineering education, recognizing the importance of diverse approaches—albeit characterized by quality and rigor—to serve the highly diverse technology needs of our society

<http://milproj.ummich.edu/publications/EngFlex%20report/download/EngFlex%20Report.pdf>

It could well be that faculty members of the twenty-first century college or university will find it necessary to set aside their roles as teachers and instead become designers of learning experiences, processes, and environments.

James Duderstadt, 1999 [Nuclear Engineering Professor; Dean, Provost and President of the University of Michigan]



A Workshop on
**Building Capability and Communities
in Engineering Education Research**

sponsored by the

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Rigorous Research in
Engineering Education Initiative

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Jack R. Lohmann
Georgia Institute of Technology



Karl A. Smith
Purdue University and
University of Minnesota

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** Scholarship of Teaching and Learning (SoTL)
 - Engages in educational experimentation, shares results
- **Level 4** Engineering Education Researcher
 - Conducts educational research, publishes archival papers

Source: Streveler, R., Borrego, M. and Smith, K.A. 2007. Moving from the “Scholarship of Teaching and Learning” to “Educational Research:” An Example from Engineering. To *Improve the Academy*, Vol. 25, 139-149.

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**

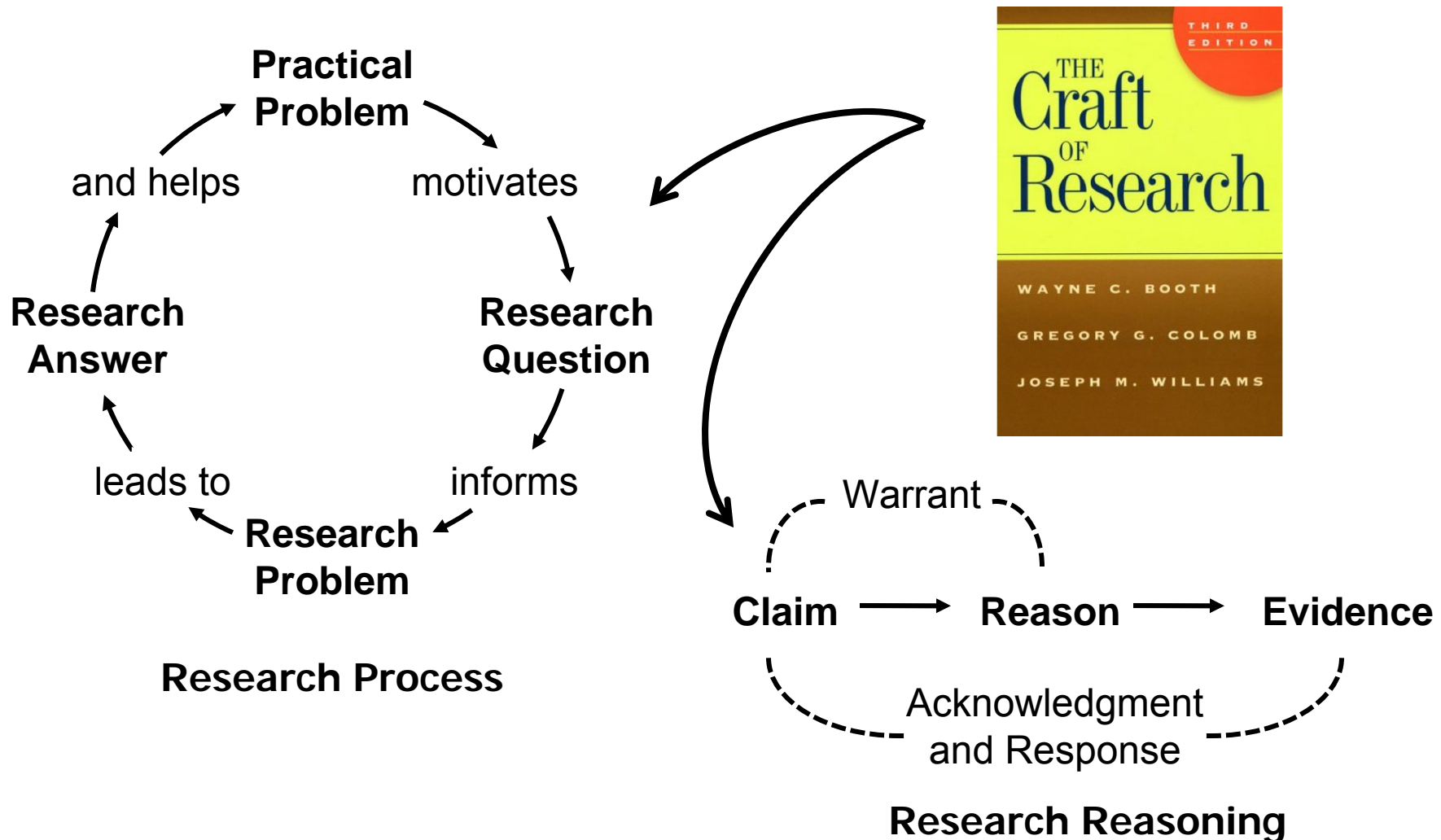


- How do our lists compare with the NRC six?



- Is a global list possible? Do cultural contexts matter?

The research process and reasoning



Some history about this workshop

- **Rigorous Research in Engineering Education (RREE1)**
 - One-week summer workshop, year-long research project
 - Funded by National Science Foundation (NSF), 2004-2006
 - About 150 engineering faculty participated
- **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



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/Purdue University &
Colorado School of Mines/Purdue University

Faculty also funded by:

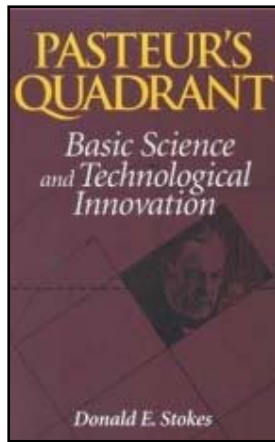
Strengthening HBCU Engineering Education
Research Capacity (NSF HRDF-041194)

- Council of HBCU Engineering Deans
- Center for the Advancement of Scholarship in Engineering Education (CASEE)
- National Academy of Engineering (NAE)

Presenters and evaluators representing

- American Society for Engineering Education (ASEE)
- American Educational Research Association (AERA)
- Professional and Organizational Development Network in Higher Education (POD)

Research can be inspired by ...



**Understanding
(Basic)**

		Use (Applied)	
		No	Yes
Yes	Pure basic research (Bohr)	Use-inspired basic research (Pasteur)	
No		Pure applied research (Edison)	

Source: Stokes, D. 1997. Pasteur's quadrant: Basic science and technological innovation. Washington, DC: Brookings Institution.

RREE2

- **Follow-up proposal has been awarded (RREE2)**
 - Includes a series of 5 short courses
 - 1) Fundamentals of Educational Research
 - 2) Identifying Theoretical Frameworks
 - 3) Designing Your Research Study
 - 4) Collaborating with Learning and Social Scientists
 - 5) Understanding Qualitative Research
 - To be available on the WWW as they become available

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