

Current State of Engineering Education



Lila M. Smith

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

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. *Improve the Academy*, Vol. 25, 139-149.

Business as usual – Linear approach



Five Major Shifts in 100 Years Of Engineering Education

1. a shift from hands-on and practical emphasis to engineering science and analytical emphasis;
2. a shift to outcomes-based education and accreditation;
3. a shift to emphasizing engineering design;
4. a shift to applying education, learning, and social-behavioral sciences research;
5. a shift to integrating information, computational, and communications technology in education.

- Froyd, J.E., Wankat, P.C. & Smith, K.A. (2012). Five major shifts in 100 years of engineering education. *Proceedings of the IEEE*
 - <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=06185632>

- **Cooperative Learning Introduced to Engineering Educators – 1981**
 - Theory – Social Interdependence – Lewin – Deutsch – Johnson & Johnson
 - Research Evidence – Randomized Design Field Experiments
 - Practice – Formal Teams/Professor’s Role



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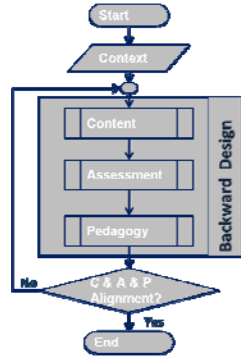
Cooperative Learning adoption - 30 years

Smith, K. 2011. Cooperative Learning: Lessons and Insights from Thirty Years of Championing a Research-Based Innovative Practice. ASEE/IEEE Frontiers in Education - Rapid City, SD

Ideal Future

Design Approach - 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. Jim Duderstadt

Content-Assessment-Pedagogy (CAP) Design Process Flowchart



Streveler, Smith & Pilotte (2011)

Understanding by Design (UdB)

Design Foundations



Sources: Bransford, Brown & Cocking. 1999. *How people learn*. National Academy Press. Wiggins, G. & McTighe, J. 2005. *Understanding by design*, 2ed. ASCD.



Expanding and sustaining research capacity in engineering and technology education: Building on successful programs for faculty and graduate students

Collaboratory for Engineering Education Research
<http://cleerhub.org>

How People Learn Engineering
- Ruth Streveler – streveler@purdue.edu

Path – Advance the State of the Art



ASEE Reports - A Path Forward



National Academy of Engineering Frontiers of Engineering Education (FOEE)

- Catalyze a vibrant community of emerging engineering education leaders
- Recognize faculty accomplishment, facilitate learning, broaden collaboration, and promote dissemination of innovative practice in engineering education



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<http://www.ce.umn.edu/~smith/links.html>