Essential Elements of Effective Teaching

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Effective Teaching: Moving Away from a Teacher-Centered Paradigm

Plenary for the Associated
Colleges of the St. Lawrence Valley

November 6, 2010

Reflection and Dialogue

- Individually reflect on your mental image of effective teaching. Write for about 1 minute.
  - Jot down words or phrases
  - Construct a figure or diagram
- Discuss with your neighbor for about 3 minutes
  - Describe your mental image and talk about similarities and differences
  - Select one Element, Image, Comment, Story, etc. that you would like to present to the whole group if you are randomly selected
- Whole group discussion

Teacher Mental Images About Teaching - Axelrod (1973)

Mental Image	**Motto**	**Characteristics**	**Disciplines**
Content	I teach what I know	Pour it in, Lecture	Science, Math
Instructor	I teach what I am	Modeling, Demonstration	Many
Student – Cognitive Development	I train minds	Active Learning, Discussion	English, Humanities
Student – Development of Whole Person	I work with students as people	Motivation, Self-esteem	Basic Skills Teachers

Axelrod, J. *The University Teacher as Artist.* San Francisco: Jossey-Bass, 1973.

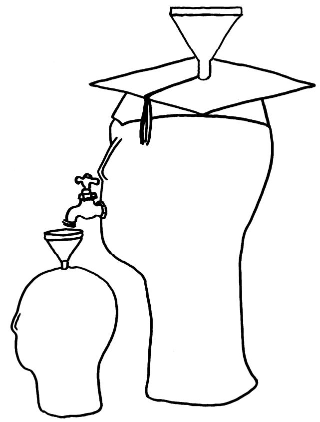
Lila M. Smith

Pedago-pathologies

Amnesia

Fantasia

Inertia



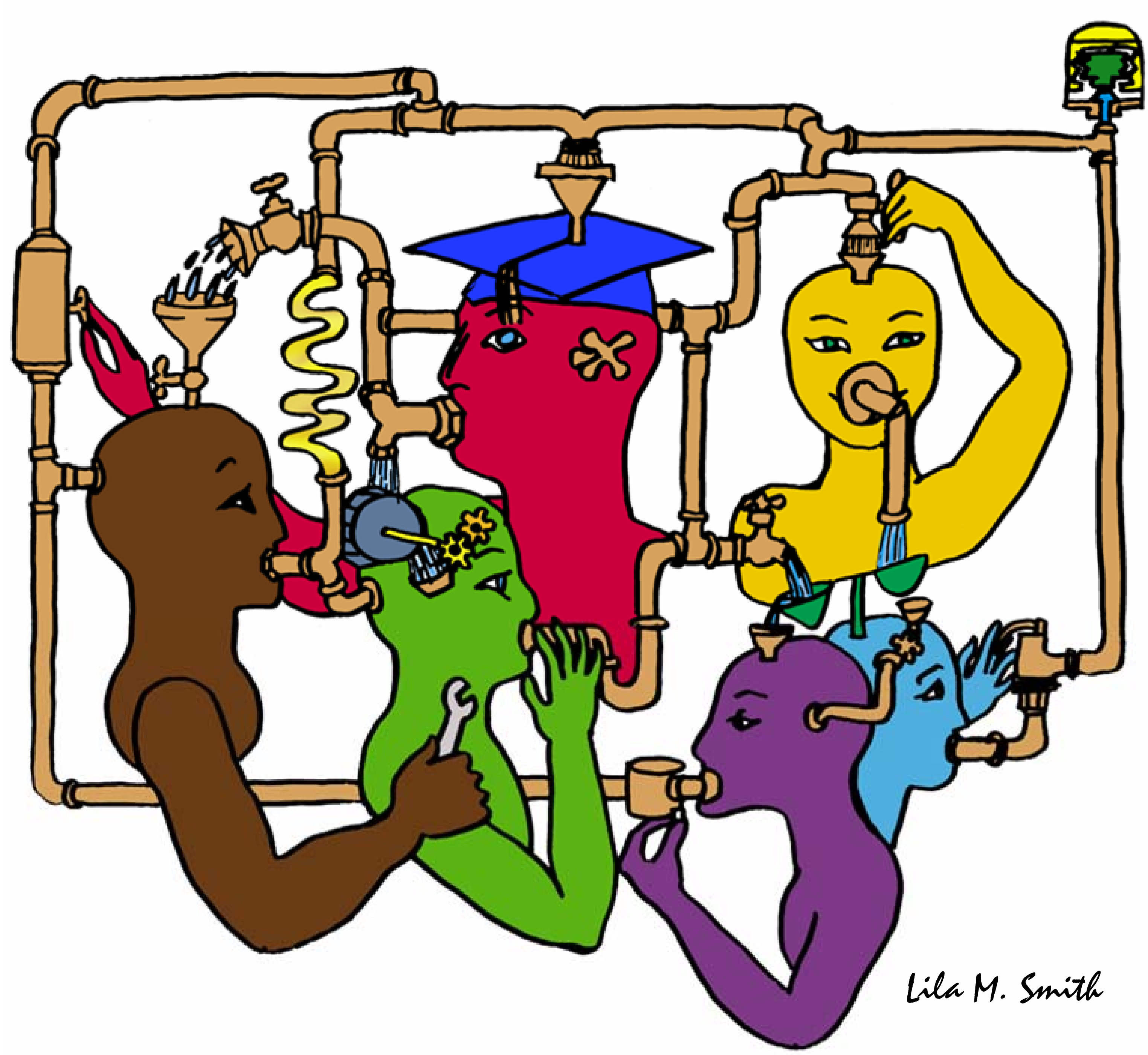
Lee Shulman – MSU Med School – PBL Approach (late 60s – early 70s), President Emeritus of the Carnegie Foundation for the Advancement of College Teaching

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

What do we do about these pathologies?

- **Activity** – Engage learners in meaningful and purposeful activities
- **Reflection** – Provide opportunities
- **Collaboration** – Design interaction
- **Passion** – Connect with things learners care about

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


Lila M. Smith

Seven Principles for Good Practice in Undergraduate Education

- Good practice in undergraduate education:
  - Encourages student-faculty contact
  - Encourages cooperation among students
  - Encourages active learning
  - Gives prompt feedback
  - Emphasizes time on task
  - Communicates high expectations
  - Respects diverse talents and ways of learning

Chickering & Gamson, June, 1987

Formulate-Share-Listen-Create (Think-Pair-Share)

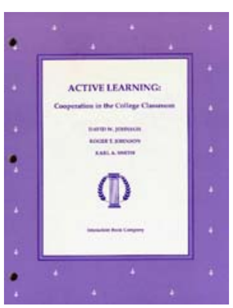
- Individually read the quote “To teach is to engage students in learning. . .”
- Underline/Highlight words and/or phrases that stand out for you
- Turn to the person next to you and talk about words and/or phrases that stood out
- Report out

To teach is to engage students in learning; thus teaching consists of getting students involved in the active construction of knowledge. . .The aim of teaching is not only to transmit information, but also to transform students from passive recipients of other people's knowledge into active constructors of their own and others' knowledge. . .Teaching is fundamentally about creating the pedagogical, social, and ethical conditions under which students agree to take charge of their own learning, individually and collectively

Education for judgment: The artistry of discussion leadership. Edited by C. Roland Christensen, David A. Garvin, and Ann Sweet. Cambridge, MA: Harvard Business School, 1991.

Comparison of Old and New Paradigm of Teaching (Johnson, Johnson & Smith, 1991)

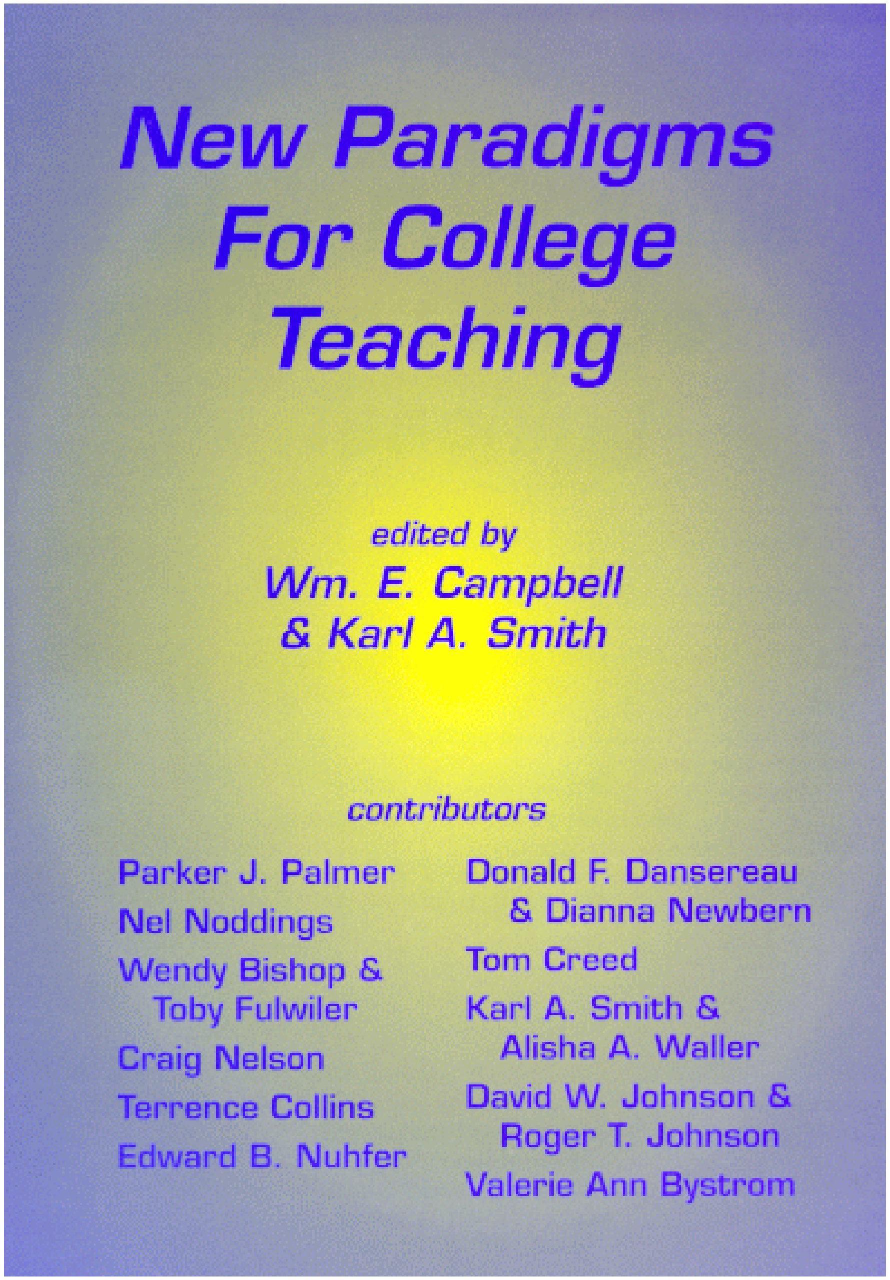
	Old Paradigm	**New Paradigm**
Knowledge	Transferred from Faculty to Students	Jointly Constructed by Students and Faculty
Students	Passive Vessel to be Filled by Faculty's Knowledge	Active Constructor, Discoverer, Transformer of Knowledge
Faculty Purpose	Classify and Sort Students	Develop Students' Competencies and Talents
Relationships	Impersonal Relationship Among Students and Between Faculty and Students	Personal Transaction Among Students and Between Faculty and Students
Context	Competitive/Individualistic	Cooperative Learning in Classroom and Cooperative Teams Among Faculty
Teaching Assumption	Any Expert can Teach	Teaching is Complex and Requires Considerable Training



Johnson, D.W., Johnson, R.T., and Smith, K.A. *Active Learning: Cooperation in the College Classroom* (1st ed.). Edina, MN: Interaction Book Company, 1991.

Robert Barr & John Tagg. From teaching to learning: A new paradigm for undergraduate education. *Change, 27*(6), 1995.

Wm. Campbell & Karl Smith. *New Paradigms for College Teaching*. Interaction Books, 1997.

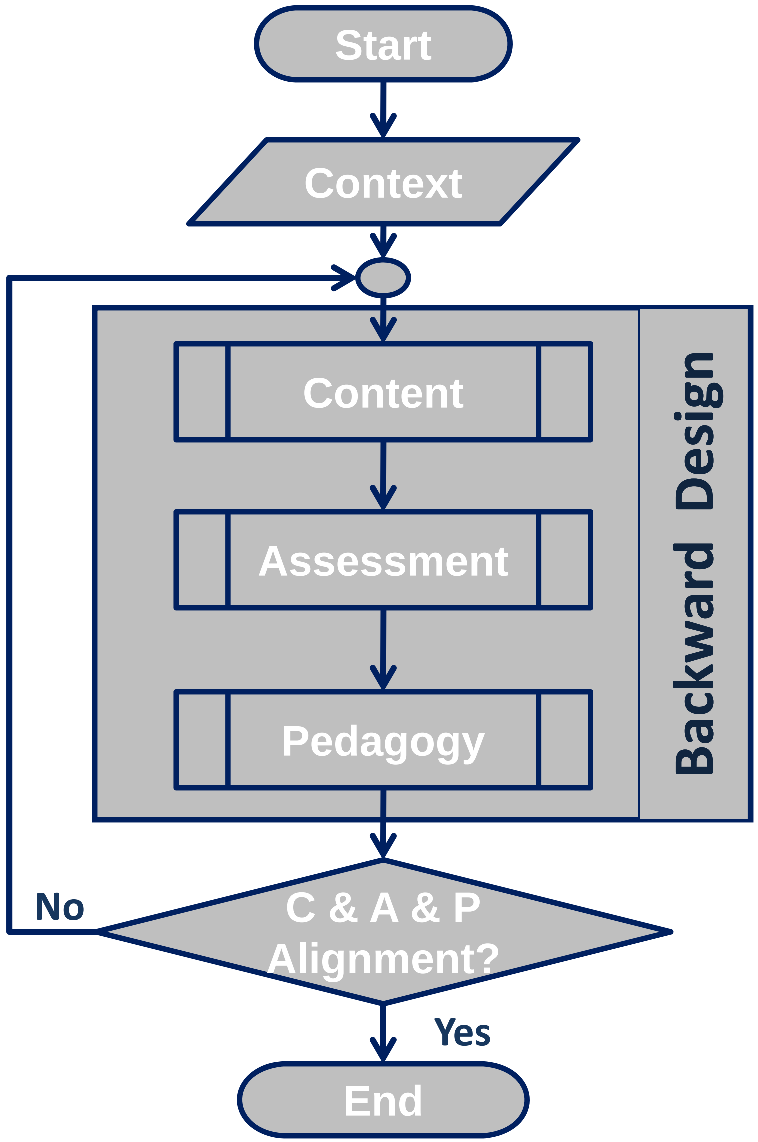


	Old Paradigm	New Paradigm
Knowledge	Transferred from Faculty to Students	Jointly Constructed by Students and Faculty
Students	Passive Vessel to be Filled by Faculty's Knowledge	Active Constructor, Discoverer, Transformer of Knowledge
Mode of Learning	Memorizing	Relating
Faculty Purpose	Classify and Sort Students	Develop Students' Competencies and Talents
Student Goals	Complete Requirements, Achieve Certification within a Discipline	Grow, Focus on Continual Lifelong Learning within a Broader System
Relationships	Impersonal Relationship Among Students and Between Faculty and Students	Personal Transaction Among Students and Between Faculty and Students
Context	Competitive/Individualistic	Cooperative Learning in Classroom and Cooperative Teams Among Faculty
Climate	Conformity/Cultural Uniformity	Diversity and Personal Esteem/ Cultural Diversity and Commonality
Power	Faculty Holds and Exercises Power, Authority, and Control	Students are Empowered; Power is Shared Among Students and Between Students and Faculty
Assessment	Norm-Referenced (i.e., Graded "On the Curve"); Typically Multiple Choice Items; Student rating of instruction at end of course	Criterion-Referenced; Typically Performances and Portfolios; Continual Assessment of Instruction
Ways of Knowing	Logico-Scientific	Narrative
Technology Use	Drill and Practice; Textbook Substitute; Chalk and Talk Substitute	Problem Solving, Communication, Collaboration, Information Access, Expression
Teaching Assumption	Any Expert can Teach	Teaching is Complex and Requires Considerable Training

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]

Content-Assessment-Pedagogy (CAP) Design Process Flowchart



Integrated Course Design (Fink, 2003)

Initial Design Phase

1. Situational Factors
2. Learning Goals
3. Feedback and Assessment
4. Teaching/Learning Activities
5. Integration

College Teaching: What do we know about it?

- Five assertions about what we know about college teaching
  - Good teaching makes a difference
  - Teachers vary markedly
  - Some characteristics/methods are present in all good teaching
  - Teaching can be evaluated and rewarded
  - There is ample room for improvement.
- K. Patricia Cross, 1991 ASEE ERM Distinguished Lecture

- Four factors in good teaching, based on student ratings*:
  - Skill. Communicates in an exciting way.
  - Rapport. Understands and emphasizes with students.
  - Structure. Provides guidance to course and material.
  - Load. Requires moderate work load.
- *Student ratings of teaching are consistent (with other measures), unbiased, and useful. Students agree on good teaching and their views are consistent with faculty.

Student Engagement Research Evidence

- Perhaps the strongest conclusion that can be made is the least surprising. Simply put, the greater the student's involvement or engagement in academic work or in the academic experience of college, the greater his or her level of knowledge acquisition and general cognitive development …(Pascarella and Terenzini, 2005).
- Active and collaborative instruction coupled with various means to encourage student engagement invariably lead to better student learning outcomes irrespective of academic discipline (Kuh et al., 2005, 2007).

See Smith, et.al, 2005 and Fairweather, 2008, Linking Evidence and Promising Practices in Science, Technology, Engineering, and Mathematics (STEM) Undergraduate Education - http://www7.nationalacademies.org/bose/Fairweather_CommissionedPaper.pdf

Pedagogies of Engagement

"Throughout the whole enterprise, the core issue, in my view, is the mode of teaching and learning that is practiced. Learning 'about' things does not enable students to acquire the abilities and understanding they will need for the twenty-first century. We need new **pedagogies of engagement** that will turn out the kinds of resourceful, engaged workers and citizens that America now requires."

Russ Edgerton (reflecting on higher education projects funded by the Pew Memorial Trust)

Pedagogies of Engagement: Classroom-Based Practices

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Abstract

Educators, researchers, and policy makers have advocated student involvement for some time as an essential aspect of meaningful learning. In the past twenty years engineering educators have implemented several means of better engaging their undergraduate students, including active and cooperative learning, learning communities, service learning, cooperative education, inquiry and problem-based learning, and team projects. This paper focuses on classroom-based pedagogies of engagement, particularly cooperative and problem-based learning. It includes a brief history, theoretical roots, research support, summary of practices, and suggestions for redesigning engineering classes and programs to include more student engagement. The paper also lays out the research ahead for advancing pedagogies aimed at more fully enhancing students' involvement in their learning.

Keywords: cooperative learning, problem-based learning, student engagement

I. Introduction to the Pedagogies of Engagement

Russ Edgerton introduced the term "pedagogies of engagement" in his 2001 *Education White Paper* [1], in which he reflected on the projects on higher education funded by the Pew Charitable Trusts. He wrote:

"Throughout the whole enterprise, the core issue, in my view, is the mode of teaching and learning that is practiced. Learning 'about' things does not enable students to acquire the abilities and understanding they will need for the twenty-first century. We need new pedagogies of engagement that will turn out the kinds of resourceful, engaged workers and citizens that America now requires."

Prior to Edgerton's paper, the widely distributed and influential publication called *The Seven Principles for Good Practice in Undergraduate Education* [2] stressed pedagogies of engagement in concept. Three of the principles speak directly to pedagogies of engagement, namely, that good practice encourages student-faculty contact, cooperation among students, and active learning.

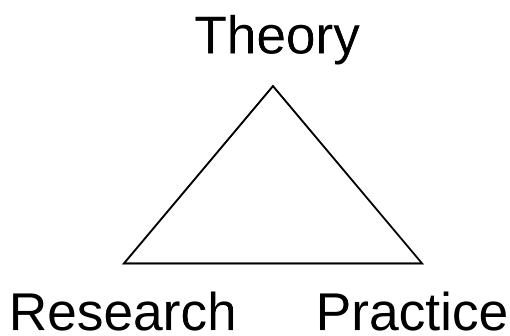
More recently, the project titled The National Survey of Student Engagement (NSSE) [3] deepens our understanding of how students perceive classroom-based learning, in all its forms, as an element in the bigger issue of student engagement in their college education. The NSSE project conceives that student engagement is not just a single course in a student's academic career, but rather a pattern of his or her involvement in a variety of activities. As such, NSSE findings are a valuable assessment tool for colleges and universities to track how successful their academic practices are in engaging their student bodies. The NSSE project is grounded in the proposition that student engagement, the frequency with which students participate in activities that represent effective educational practice, is a meaningful proxy for collegiate quality and, therefore, by extension, quality of education. The annual survey of freshmen and seniors asks students how often they have, for example, participated in projects that required integrating ideas or information from various sources, used e-mail to communicate with an instructor, asked questions in class or contributed to class discussions, received prompt feedback from faculty on their academic performance, participated in community-based projects, or tutored or taught other students. Student responses are organized around five benchmarks:

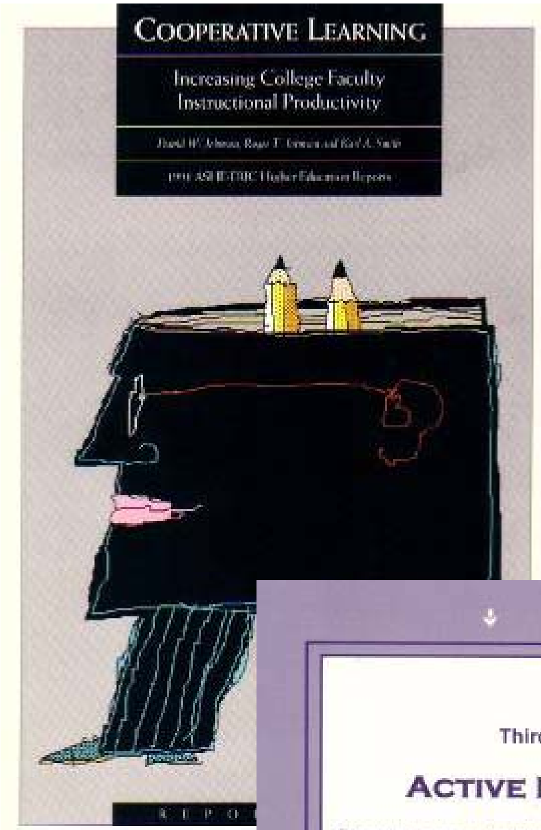
1. *Level of academic challenge:* Schools encourage achievement by setting high expectations and emphasizing importance of student effort.
2. *Active and collaborative learning:* Students learn more when intensely involved in educational process and are encouraged to apply their knowledge in many situations.
3. *Student-faculty interaction:* Students able to learn from experts and faculty serve as role models and mentors.
4. *Enriching educational experience:* Learning opportunities inside and outside classroom (diversity, technology, collaboration, internships, community service, capstones) enhance learning.
5. *Supportive campus environment:* Students are motivated and satisfied at schools that actively promote learning and stimulate social interaction.

Astin's [4] large-scale correlational study of what matters in college (involving 27,064 students at 309 baccalaureate-granting institutions) found that two environmental factors were by far the most predictive of positive change in college students' academic development, personal development, and satisfaction. These two factors—interaction among students and interaction between faculty and

Cooperative Learning

- Theory – Social Interdependence – Lewin – Deutsch – Johnson & Johnson
- Research – Randomized Design Field Experiments
- Practice – Formal Teams/Professor's Role





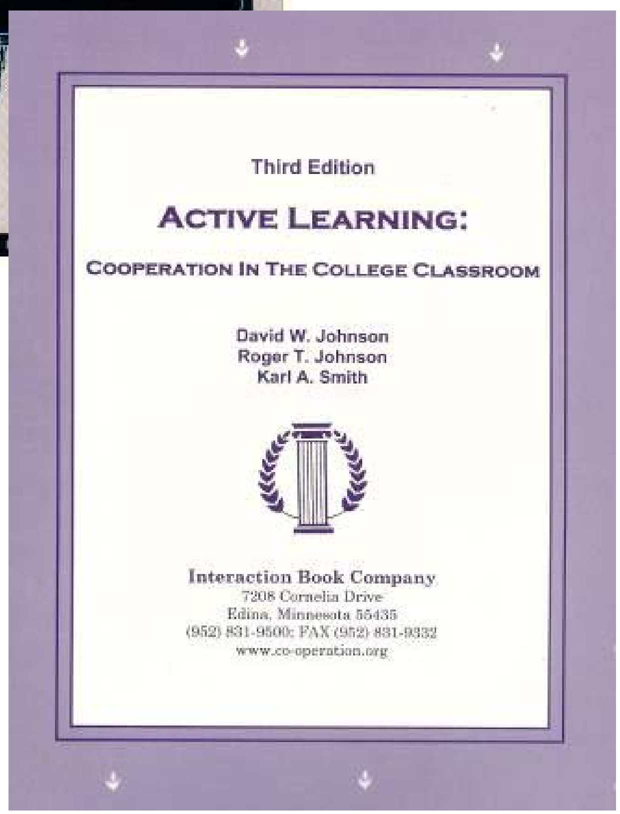
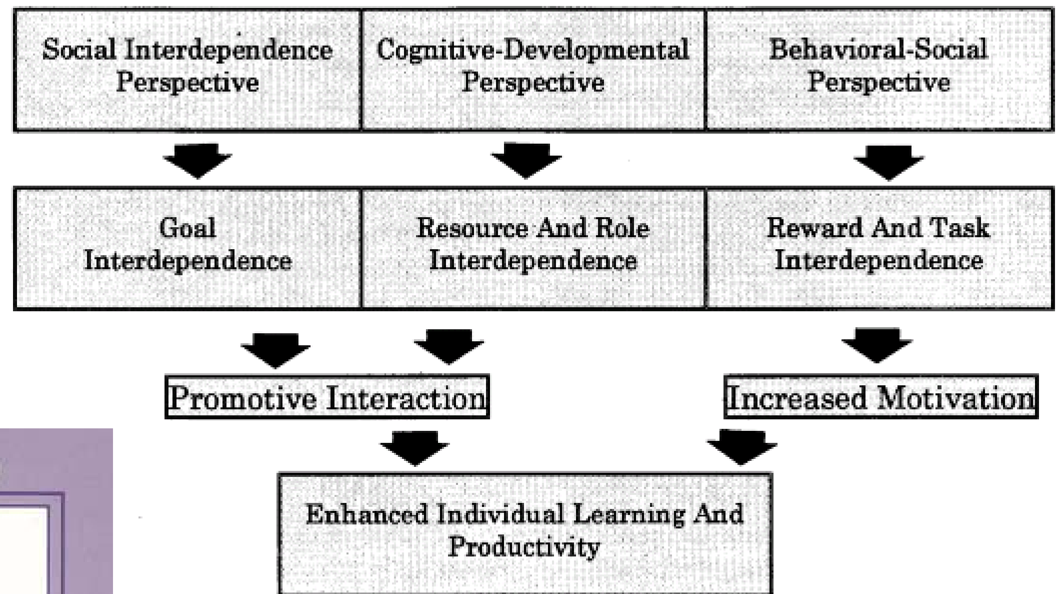


Figure A.1 A General Theoretical Framework



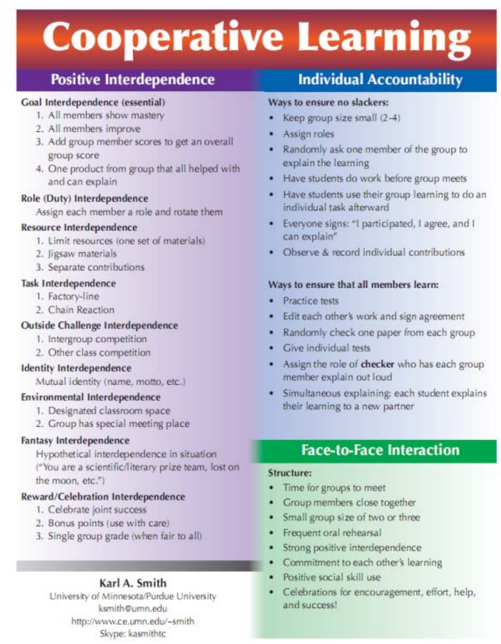
Cooperative Learning

- •Positive Interdependence
- •Individual and Group Accountability
- •Face-to-Face Promotive Interaction
- •Teamwork Skills
- •Group Processing

Cooperative Learning is instruction that involves people working in teams to accomplish a common goal, under conditions that involve both *positive interdependence* (all members must cooperate to complete the task) and *individual and group accountability* (each member is accountable for the complete final outcome).

Key Concepts

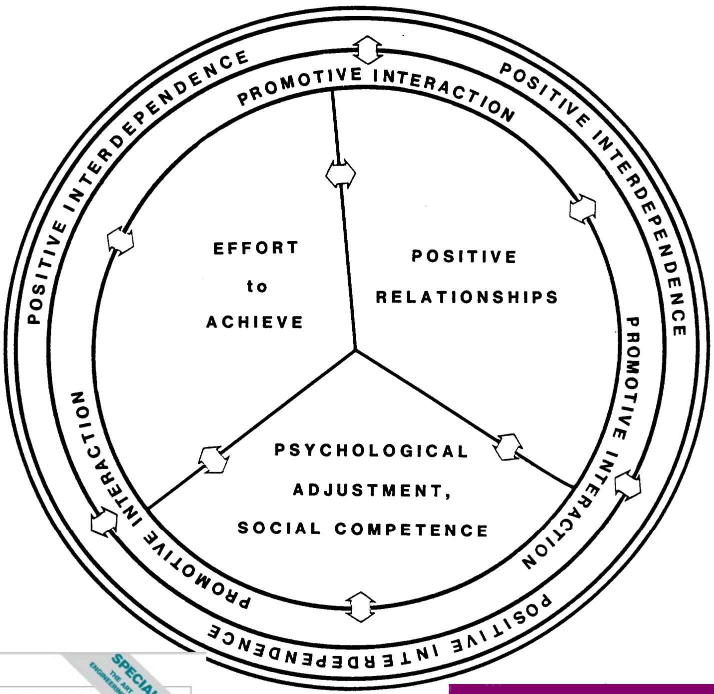
- Positive Interdependence
- Individual and Group Accountability
- Face-to-Face Promotive Interaction
- Teamwork Skills
- Group Processing



Cooperative Learning Research Support

Johnson, D.W., Johnson, R.T., & Smith, K.A. 1998. Cooperative learning returns to college: What evidence is there that it works? *Change*, *30* (4), 26-35.

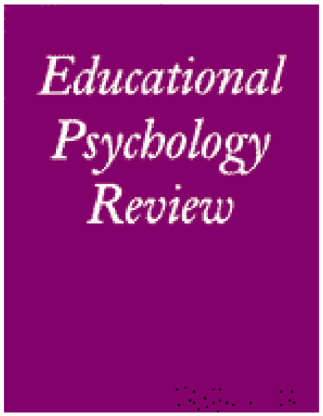
- Over 300 Experimental Studies
- First study conducted in 1924
- High Generalizability
- Multiple Outcomes



Outcomes

1. Achievement and retention
2. Critical thinking and higher-level reasoning
3. Differentiated views of others
4. Accurate understanding of others' perspectives
5. Liking for classmates and teacher
6. Liking for subject areas
7. Teamwork skills

January 2005



March 2007

Active and Cooperative Learning

Farewell, Lecture?

A physics professor describes his evolution from lecturing to dynamically engaging students during class and improving how they learn.

Eric Mazur

Discussions of education are generally predicated on the assumption that we know what education is. I hope to convince you otherwise by recounting some of my own experiences. When I started teaching introductory physics to undergraduates at Harvard University, I never asked myself how I would educate my students. I did what my teachers had done—I lectured. I thought that was how one learns. Look around anywhere in the world and you'll find lecture halls filled with students and, at the front, an instructor. This approach to education has not changed since before the Renaissance and the birth of scientific inquiry. Early in my career I received the first hints that something was wrong with teaching in this manner, but I had ignored it. Sometimes it's hard to face reality.

When I started teaching, I prepared lecture notes and then taught from them. Because my lectures deviated from the textbook, I provided students with copies of these lecture notes. The infuriating result was that on my end-of-semester evaluations—which were quite good otherwise—a number of students complained that I was "lecturing straight from (his) lecture notes." What was I supposed to do? Develop a set of lecture notes different from the ones I handed out? I decided to ignore the students' complaints.

Click here. Students continually discuss concepts among themselves and with the instructor during class. Discussions are spurred by multiple-choice conceptual questions that students answer using a clicker device. See supporting online text for examples of such "clicker questions."

A few years later, I discovered that the students were right. My lecturing was ineffective, despite the high evaluations. Early on in the physics curriculum—in week 2 of a typical introductory physics course—the Laws of Newton are presented. Every student in such a course can recite Newton's third law of motion, which states that the force of object A on object B in an interaction between two objects is equal in magnitude to the force of B on A—it sometimes is known as "action is reaction." One day, when the course had progressed to more complicated material, I decided to test my students' understanding of this concept not by doing traditional problems, but by asking them a set of basic conceptual questions (*1*, *2*). One of the questions, for example, requires students to compare the forces that a heavy truck and a light car exert on one another when they collide. I expected that the students would have no trouble tackling such questions, but much to my surprise, hardly a minute after the test began, one student asked, "How should I answer these questions? According to what you taught me or according to the way I usually think about these things?" To my dismay, students had great difficulty with the conceptual questions. That was when it began to dawn on me that something was amiss.

In hindsight, the reason for my students' poor performance is simple. The traditional approach to teaching reduces education to a transfer of information. Before the industrial revolution, when books were not yet mass commodities, the lecture method was the only way to transfer information from one generation to the next. However, education is so

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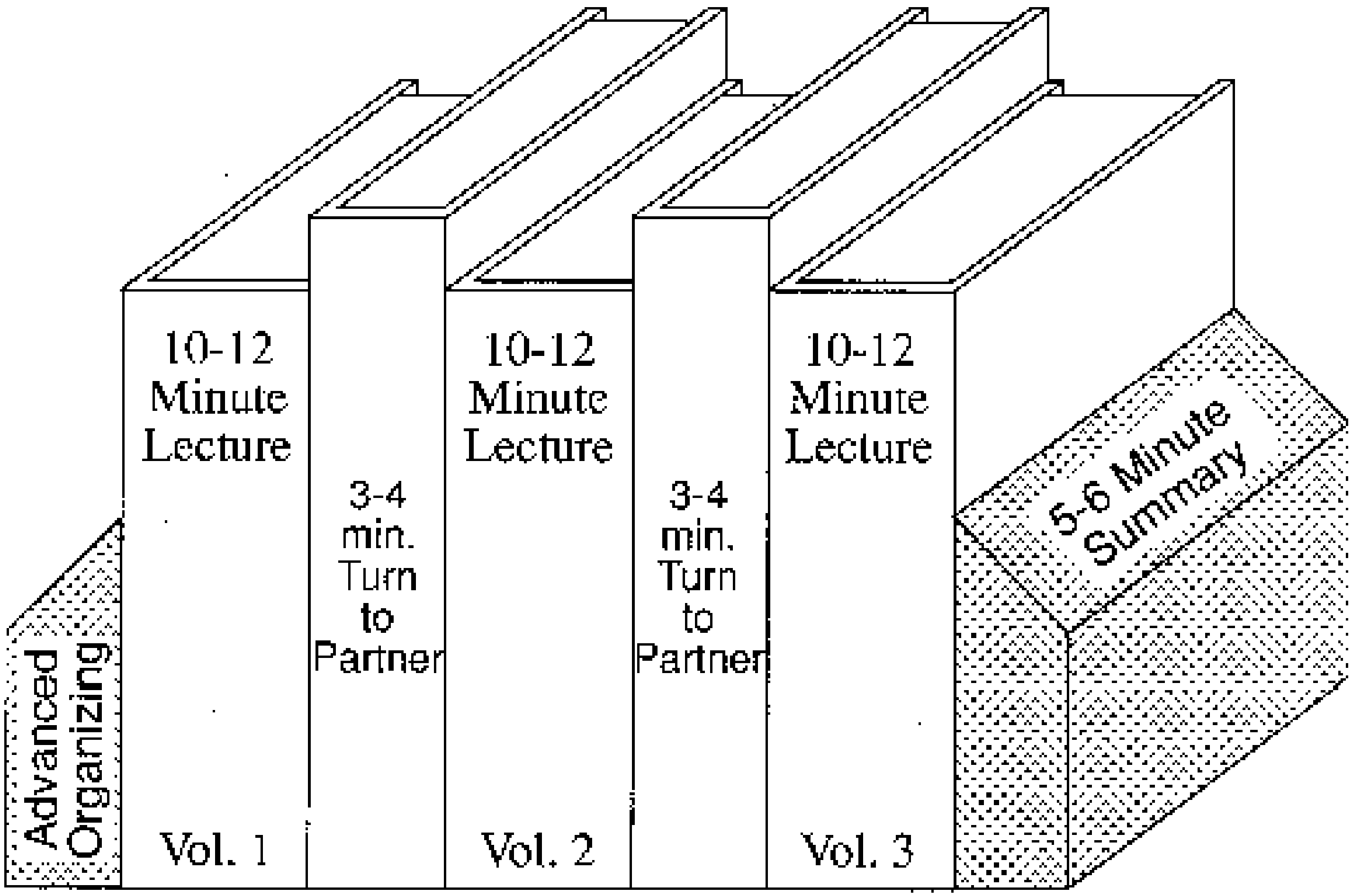
January 2, 2009—Science, Vol. 323 – www.sciencemag.org

Calls for evidence-based promising practices

Book Ends on a Class Session



Thinking Together: Collaborative Learning in the Sciences – Harvard University – Derek Bok Center – www.fas.harvard.edu/~bok_cen/

Cooperative Learning

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

Jodi Hilton for The New York Times

The Massachusetts Institute of Technology has changed the way it offers some introductory classes. Prof. Gabriella Sciolla at a class on electricity and magnetism.

By SARA RIMER
Published: January 12, 2009

COMMENTS (00)
E-MAIL
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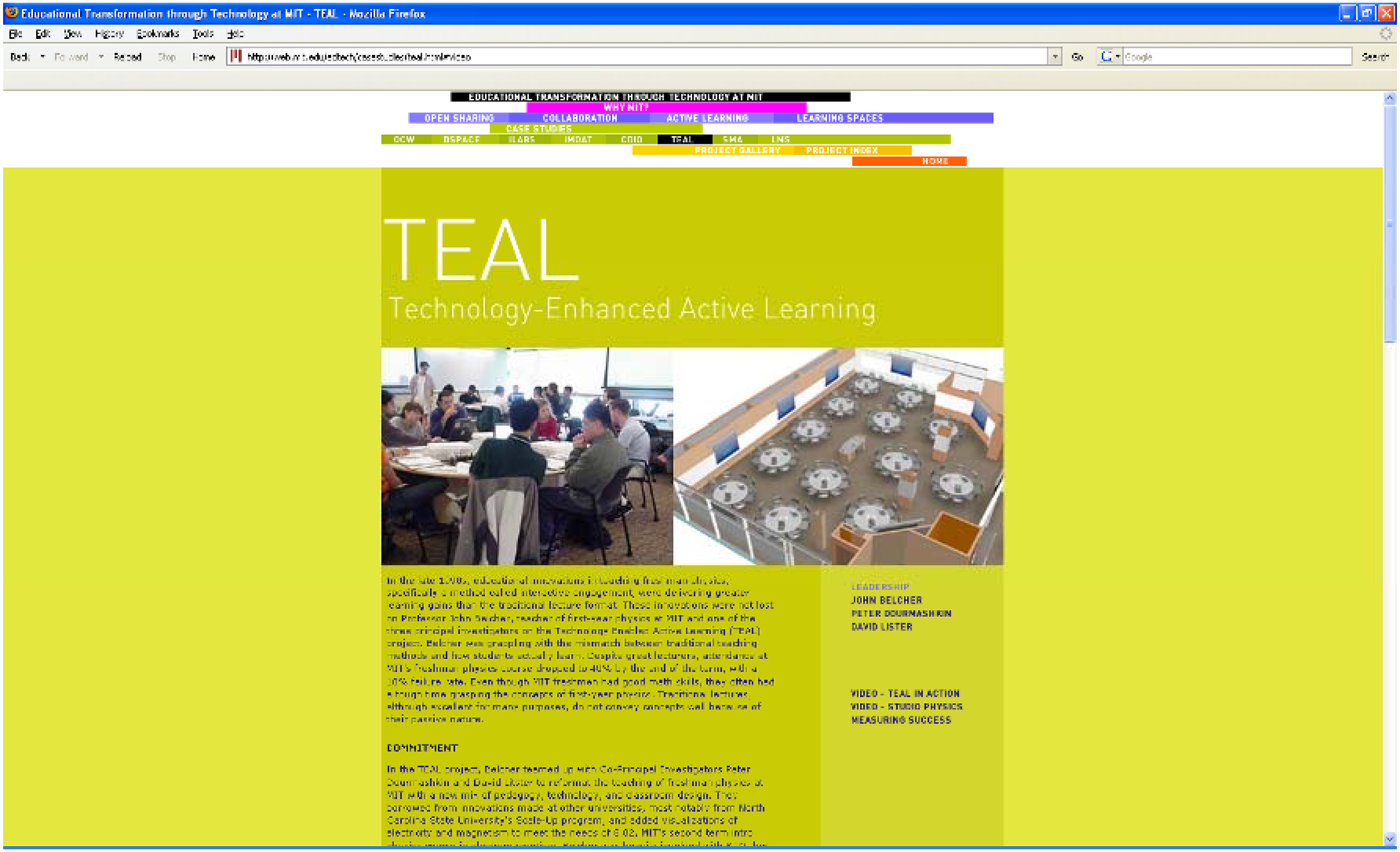
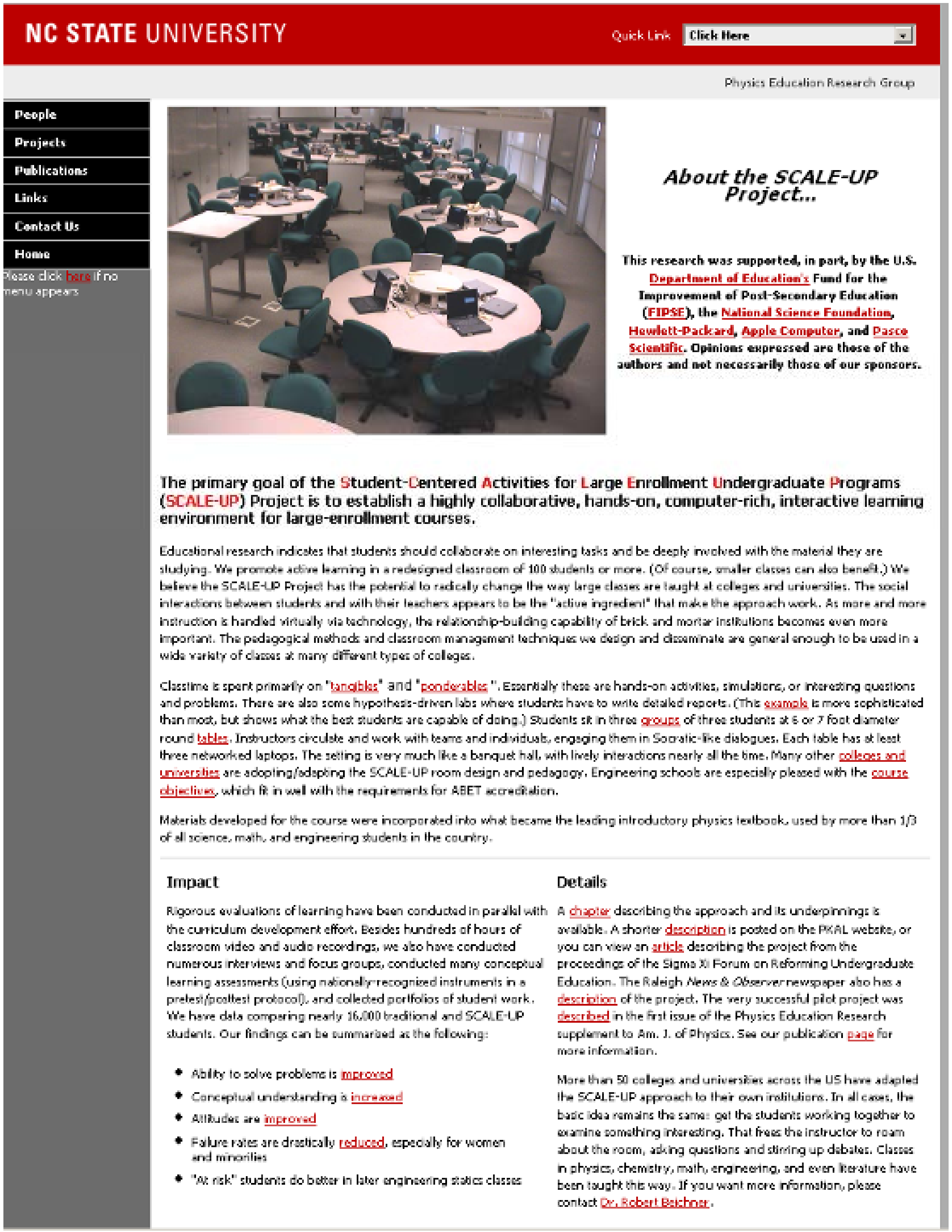
SINGLE PAGE

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,

January 13, 2009—New York Times – http://www.nytimes.com/2009/01/13/us/13physics.html?em



http://web.mit.edu/edtech/casestudies/teal.html#video



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About the SCALE-UP Project...

This research was supported, in part, by the U.S. Department of Education's Fund for the Improvement of Post-Secondary Education (FIPSE), the National Science Foundation, Hewlett-Packard, Apple Computer, and Pasco Scientific. Opinions expressed are those of the authors and not necessarily those of our sponsors.

The primary goal of the Student-Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP) Project is to establish a highly collaborative, hands-on, computer-rich, interactive learning environment for large-enrollment courses.

Educational research indicates that students should collaborate on interesting tasks and be deeply involved with the material they are studying. We promote active learning in a redesigned classroom of 100 students or more. (Of course, smaller classes can also benefit.) We believe the SCALE-UP Project has the potential to radically change the way large classes are taught at colleges and universities. The social interactions between students and with their teachers appears to be the "active ingredient" that make the approach work. As more and more instruction is handled virtually via technology, the relationship-building capability of brick and mortar institutions becomes even more important. The pedagogical methods and classroom management techniques we design and disseminate are general enough to be used in a wide variety of classes at many different types of colleges.

Classtime is spent primarily on "tangibles" and "ponderables". Essentially these are hands-on activities, simulations, or interesting questions and problems. There are also some hypothesis-driven labs where students have to write detailed reports. (This example is more sophisticated than most, but shows what the best students are capable of doing.) Students sit in three groups of three students at 6 or 7 foot diameter round tables. Instructors circulate and work with teams and individuals, engaging them in Socratic-like dialogues. Each table has at least three networked laptops. The setting is very much like a banquet hall, with lively interactions nearly all the time. Many other colleges and universities are adopting/adapting the SCALE-UP room design and pedagogy. Engineering schools are especially pleased with the course objectives, which fit in well with the requirements for ABET accreditation.

Materials developed for the course were incorporated into what became the leading introductory physics textbook, used by more than 1/3 of all science, math, and engineering students in the country.

Impact

Rigorous evaluations of learning have been conducted in parallel with the curriculum development effort. Besides hundreds of hours of classroom video and audio recordings, we also have conducted numerous interviews and focus groups, conducted many conceptual learning assessments (using nationally-recognized instruments in a pretest/posttest protocol), and collected portfolios of student work. We have data comparing nearly 16,000 traditional and SCALE-UP students. Our findings can be summarized as the following:

- Ability to solve problems is improved
- Conceptual understanding is increased
- Attitudes are improved
- Failure rates are drastically reduced, especially for women and minorities
- "At risk" students do better in later engineering statics classes

Details

A chapter describing the approach and its underpinnings is available. A shorter description is posted on the PKAL website, or you can view an article describing the project from the proceedings of the Sigma Xi Forum on Reforming Undergraduate Education. The Raleigh *News & Observer* newspaper also has a description of the project. The very successful pilot project was described in the first issue of the Physics Education Research supplement to Am. J. of Physics. See our publication page for more information.

More than 50 colleges and universities across the US have adapted the SCALE-UP approach to their own institutions. In all cases, the basic idea remains the same: get the students working together to examine something interesting. That frees the instructor to roam about the room, asking questions and stirring up debates. Classes in physics, chemistry, math, engineering, and even literature have been taught this way. If you want more information, please contact Dr. Robert Beichner.

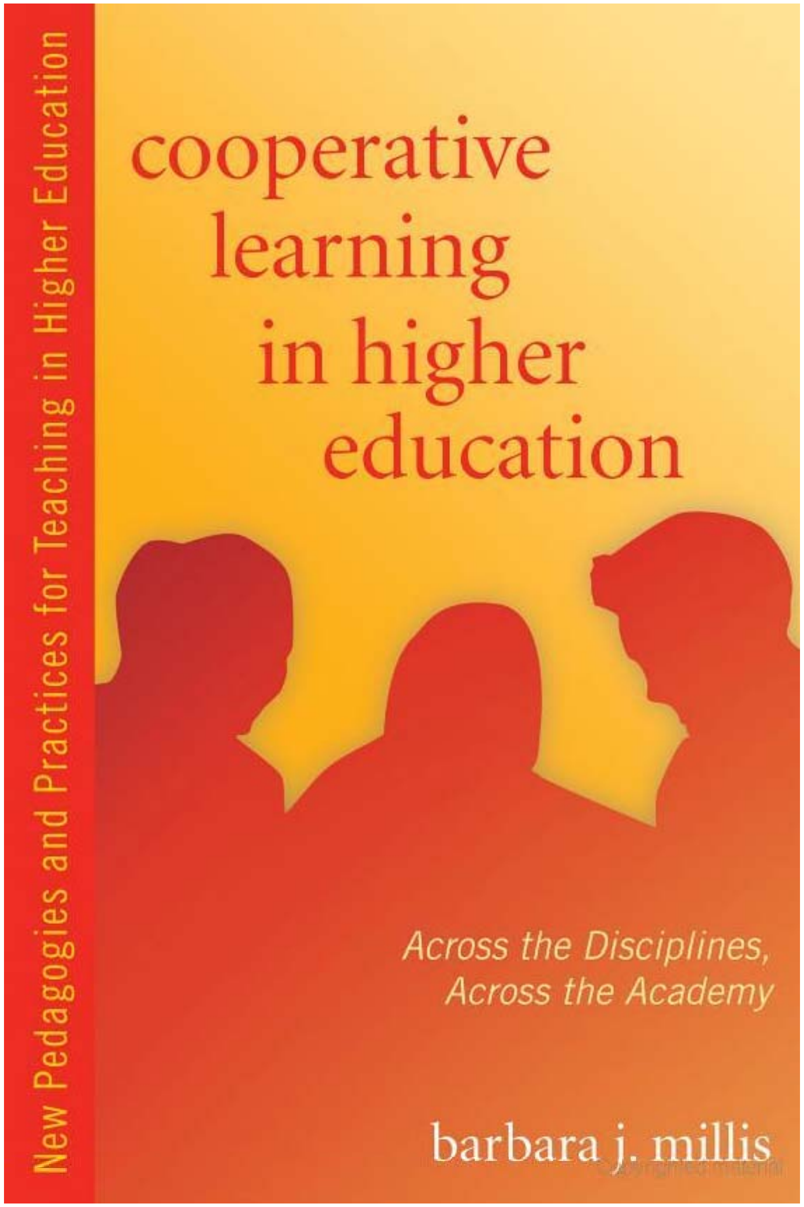
http://www.ncsu.edu/PER/scaleup.html

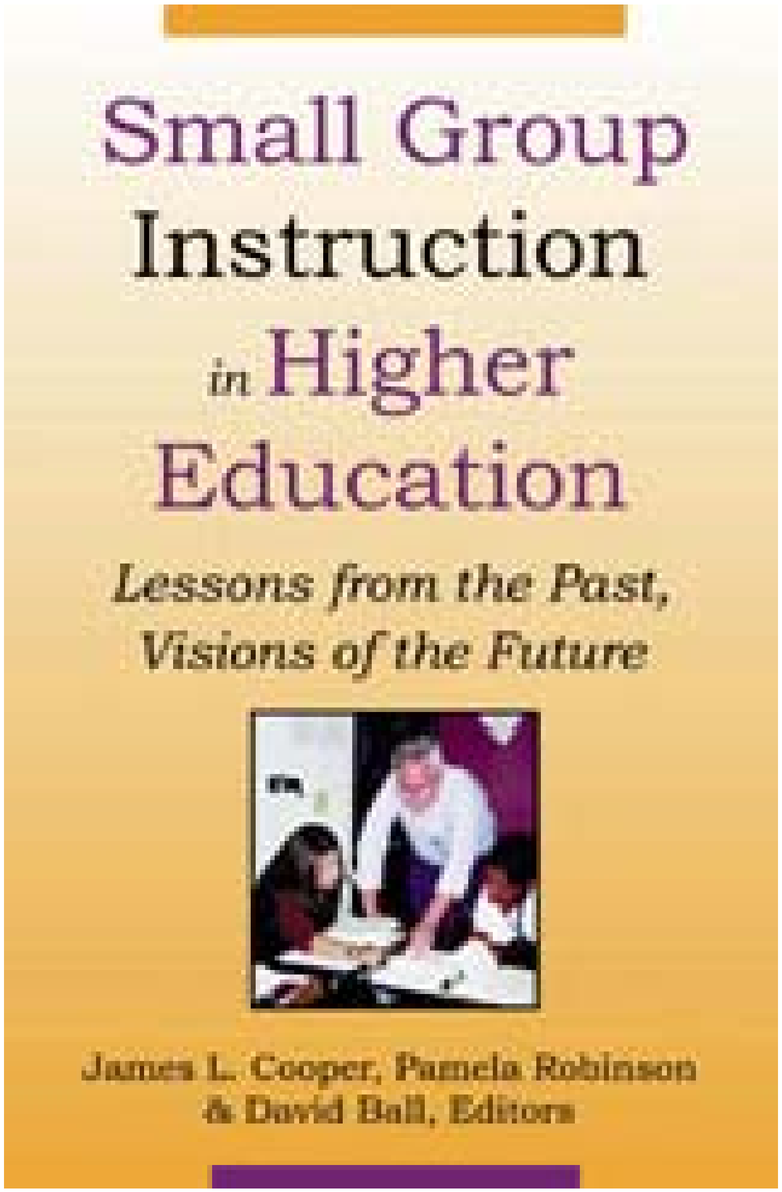
The American College Teacher:

National Norms for 2007-2008

Methods Used in “All” or “Most”	All – 2005	All – 2008	Assistant - 2008
Cooperative Learning	48	59	66
Group Projects	33	36	61
Grading on a curve	19	17	14
Term/research papers	35	44	47

http://www.heri.ucla.edu/index.php


New Pedagogies and Practices for Teaching in Higher Education
cooperative learning in higher education
Across the Disciplines, Across the Academy
barbara j. millis


Small Group Instruction in Higher Education
Lessons from the Past, Visions of the Future
James L. Cooper, Pamela Robinson & David Ball, Editors

Good teaching comes from the identity and integrity of the teacher.

Good teachers possess a capacity for connectedness.

Parker J. Palmer in *The courage to teach: Exploring the inner landscape of a teacher's* life. Jossey-Bass, 1998.

The biggest and most long-lasting reforms of undergraduate education will come when individual faculty or small groups of instructors adopt the view of themselves as reformers within their immediate sphere of influence, the classes they teach every day.

K. Patricia Cross

Resources

- Design Framework – How People Learn (HPL) & Backward Design Process
  - Creating High Quality Learning Environments (Bransford, Vye & Bateman) -- http://www.nap.edu/openbook/0309082927/html/
  - Pellegrino – Rethinking and redesigning curriculum, instruction and assessment: What contemporary research and theory suggests. http://www.skillscommission.org/commissioned.htm
  - Smith, K. A., Douglas, T. C., & Cox, M. 2009. Supportive teaching and learning strategies in STEM education. In R. Baldwin, (Ed.). Improving the climate for undergraduate teaching in STEM fields. New Directions for Teaching and Learning, 117, 19-32. San Francisco: Jossey-Bass.
- Content Resources
  - Donald, Janet. 2002. Learning to think: Disciplinary perspectives. San Francisco: Jossey-Bass.
  - Middendorf, Joan and Pace, David. 2004. Decoding the Disciplines: A Model for Helping Students Learn Disciplinary Ways of Thinking. New Directions for Teaching and Learning, 98.
- Cooperative Learning - Instructional Format explanation and exercise to model format and to engage workshop participants
  - Cooperative Learning (Johnson, Johnson & Smith)
    - Smith web site – www.ce.umn.edu/~smith
  - Smith (2010) Social nature of learning: From small groups to learning communities. New Directions for Teaching and Learning, 2010, 123, 11-22 [NDTL-123-2-Smith-Social_Basis_of_Learning-.pdf]
  - Smith, Sheppard, Johnson & Johnson (2005) Pedagogies of Engagement [Smith-Pedagogies_of_Engagement.pdf]
  - Cooperative learning returns to college: What evidence is there that it works? Change, 1998, 30 (4), 26-35. [CLReturnstoCollege.pdf]
- Other Resources
  - University of Delaware PBL web site – www.udel.edu/pbl
  - PKAL – Pedagogies of Engagement – http://www.pkal.org/activities/PedagogiesOfEngagementSummit.cfm
  - Fairweather (2008) Linking Evidence and Promising Practices in Science, Technology, Engineering, and Mathematics (STEM) Undergraduate Education - http://www7.nationalacademies.org/bose/Fairweather_CommissionedPaper.pdf