

Design and Implementation of Active and Cooperative Learning

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Faculty Development Days

Bismarck State College

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Session Layout

- Welcome & Overview
- Cooperative Learning Review
 - Key Elements
 - Instructor's Role
- Implementation of Cooperative Learning
 - Informal – Bookends on a Class Session
 - Formal Cooperative Learning –
 - Cooperative Problem Based Learning

Participant Learning Goals (Objectives)

- Describe key features of Cooperative Learning
 - Five Essential Elements
 - Instructor's Role
- Explain rationale for Pedagogies of Engagement, especially Cooperative Learning & Challenge Based Learning
- Apply cooperative learning to classroom practice
- Identify connections between cooperative learning and desired outcomes of courses and programs

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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	
Positive Interdependence	Individual Accountability
<ul style="list-style-type: none"> • All members share resources • All members are responsible • All group members share to get on track • All group members share to get on track • All group members share to get on track 	<ul style="list-style-type: none"> • Each member is responsible • Each member is responsible • Each member is responsible • Each member is responsible • Each member is responsible
Face-to-Face Promotive Interaction	Teamwork Skills
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Cooperative Learning

Positive Interdependence

Goal Interdependence (essential)

1. All members show mastery
2. All members improve
3. Add group member scores to get an overall group score
4. One product from group that all helped with and can explain

Role (Duty) Interdependence

Assign each member a role and rotate them

Resource Interdependence

1. Limit resources (one set of materials)
2. Jigsaw materials
3. Separate contributions

Task Interdependence

1. Factory-line
2. Chain Reaction

Outside Challenge Interdependence

1. Intergroup competition
2. Other class competition

Identity Interdependence

Mutual identity (name, motto, etc.)

Environmental Interdependence

1. Designated classroom space
2. Group has special meeting place

Fantasy Interdependence

Hypothetical interdependence in situation ("You are a scientific/literary prize team, lost on the moon, etc.")

Reward/Celebration Interdependence

1. Celebrate joint success
2. Bonus points (use with care)
3. Single group grade (when fair to all)

Individual Accountability

Ways to ensure no slackers:

- Keep group size small (2-4)
- Assign roles
- Randomly ask one member of the group to explain the learning
- Have students do work before group meets
- Have students use their group learning to do an individual task afterward
- Everyone signs: "I participated, I agree, and I can explain"
- Observe & record individual contributions

Ways to ensure that all members learn:

- Practice tests
- Edit each other's work and sign agreement
- Randomly check one paper from each group
- Give individual tests
- Assign the role of **checker** who has each group member explain out loud
- Simultaneous explaining: each student explains their learning to a new partner

Face-to-Face Interaction

Structure:

- Time for groups to meet
- Group members close together
- Small group size of two or three
- Frequent oral rehearsal
- Strong positive interdependence
- Commitment to each other's learning
- Positive social skill use
- Celebrations for encouragement, effort, help, and success!

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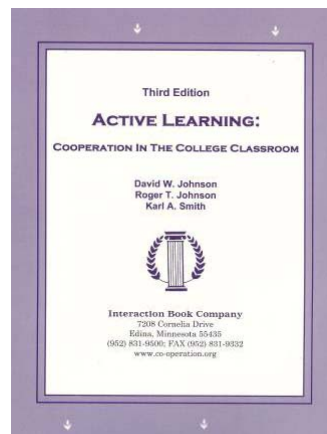
<http://www.ce.umn.edu/~smith>

Skype: ksamihic

<http://www.ce.umn.edu/~smith/docs/Smith-CL%20Handout%2008.pdf>

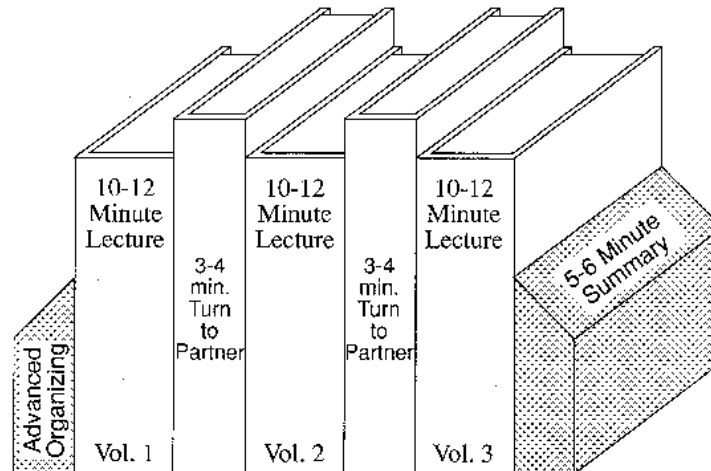
Active Learning: Cooperation in the College Classroom

- **Informal** Cooperative Learning Groups
- **Formal** Cooperative Learning Groups
- Cooperative **Base** Groups



See Cooperative Learning Handout (CL College-804.doc) 6

Book Ends on a Class Session



Smith, K.A. 2000. Going deeper: Formal small-group learning in large classes. Energizing large classes: From small groups to learning communities. *New Directions for Teaching and Learning*, 2000, 81, 25-46. [[NDTL81Ch3GoingDeeper.pdf](#)]

Book Ends on a Class Session

1. Advance Organizer
2. Formulate-Share-Listen-Create (Turn-to-your-neighbor) -- repeated every 10-12 minutes
3. Session Summary (Minute Paper)
 1. What was the most useful or meaningful thing you learned during this session?
 2. What question(s) remain uppermost in your mind as we end this session?
 3. What was the "muddiest" point in this session?

Advance Organizer

“The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly.”

David Ausubel - Educational psychology: A cognitive approach, 1968.

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Quick Thinks

- Reorder the steps
- Paraphrase the idea
- Correct the error
- Support a statement
- Select the response

Johnston, S. & Cooper, J. 1997. Quick thinks: Active-thinking in lecture classes and televised instruction. Cooperative learning and college teaching, 8(1), 2-7.

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Formulate-Share-Listen-Create

Informal Cooperative Learning Group
Introductory Pair Discussion of a

FOCUS QUESTION

1. Formulate your response to the question **individually**
2. Share your answer with a partner
3. Listen carefully to your partner's answer
4. Work together to Create a new answer through discussion ¹¹

Minute Paper

- What was the most useful or meaningful thing you learned during this session?
- What question(s) remain uppermost in your mind as we end this session?
- What was the “muddiest” point in this session?
- Give an example or application
- Explain in your own words . . .

Angelo, T.A. & Cross, K.P. 1993. Classroom assessment techniques: A handbook for college teachers. San Francisco: Jossey Bass.

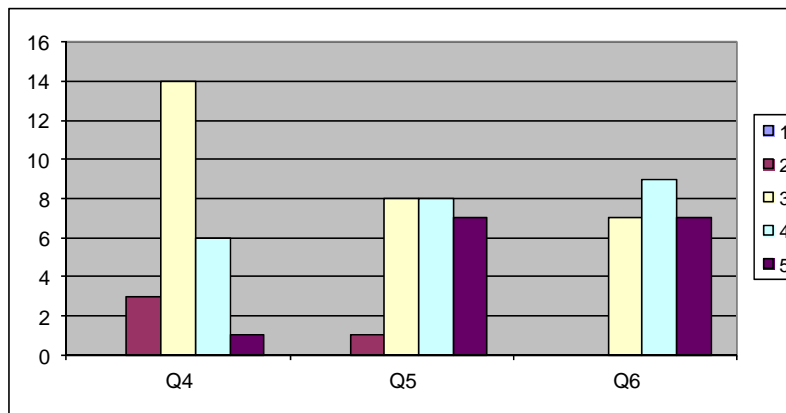
Session Summary (Minute Paper)

Reflect on the session:

1. Most interesting, valuable, useful thing you learned.
2. Things that helped you learn.
3. Question, comments, suggestions.
4. Pace: Too slow 1 5 Too fast
5. Relevance: Little 1 . . . 5 Lots
6. Instructional Format: Ugh 1 . . . 5 Ah

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MOT 8221 – Spring 2012 – Session 1 (1/6/12)

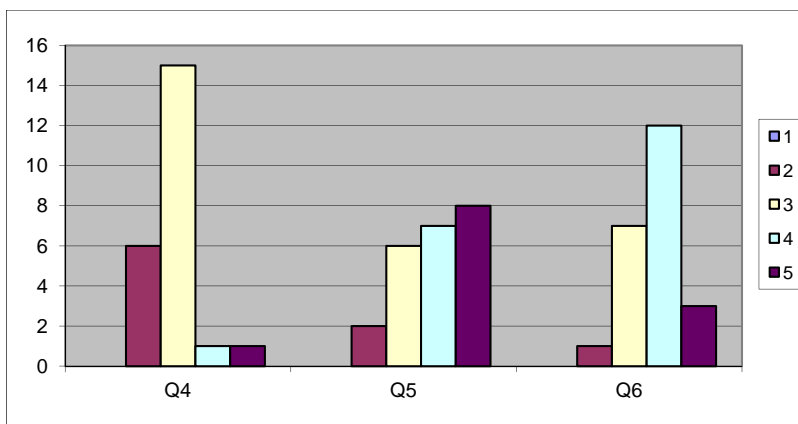


Q4 – Pace: Too slow 1 5 Too fast (3.2)

Q5 – Relevance: Little 1 . . . 5 Lots (3.9)

Q6 – Format: Ugh 1 . . . 5 Ah (4.0)

MOT 8221 – Spring 2011 – Session 1 (3/25/11)



Q4 – Pace: Too slow 1 . . . 5 Too fast (2.9)

Q5 – Relevance: Little 1 . . . 5 Lots (3.9)

Q6 – Format: Ugh 1 . . . 5 Ah (3.7)

Informal CL (Book Ends on a Class Session) with Concept Tests

Physics

Peer Instruction

Eric Mazur - Harvard – <http://galileo.harvard.edu>

Peer Instruction – www.prenhall.com

Richard Hake – <http://www.physics.indiana.edu/~hake/>

Chemistry

Chemistry ConcepTests - UW Madison

www.chem.wisc.edu/~concept

Video: Making Lectures Interactive with ConcepTests

ModularChem Consortium – <http://mc2.cchem.berkeley.edu/>

STEMTEC

Video: How Change Happens: Breaking the “Teach as You Were Taught” Cycle – Films for the Humanities & Sciences – www.films.com

Harvard – Derek Bok Center

Thinking Together & From Questions to Concepts: Interactive Teaching in Physics

– www.fas.harvard.edu/~bok_cen/ 16

The “Hake” Plot of FCI

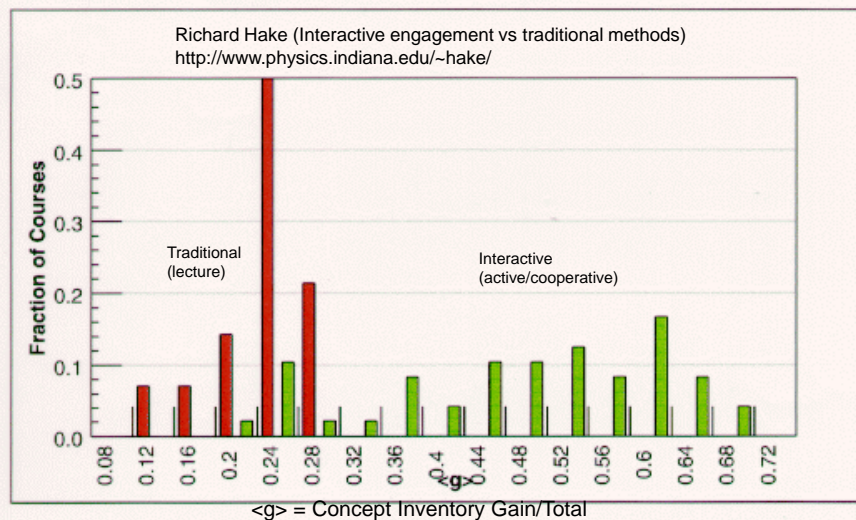
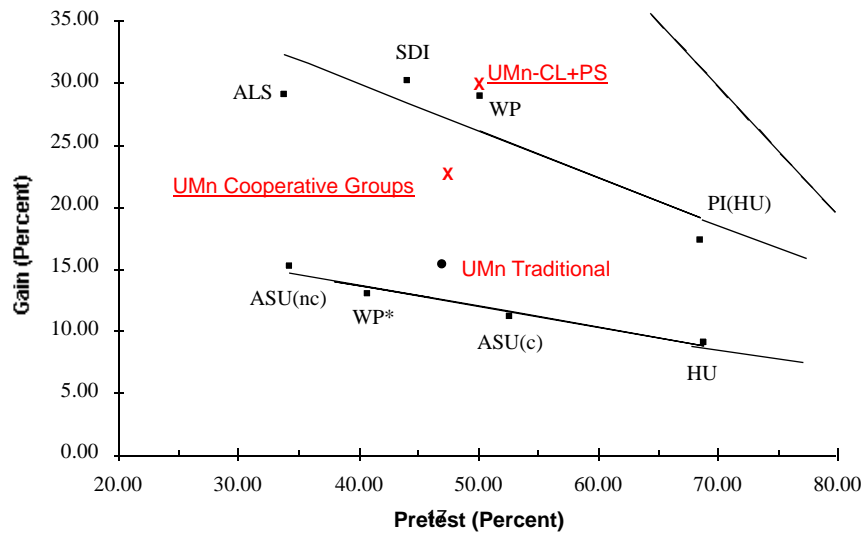


Fig. 2. Histogram of the average normalized gain $\langle g \rangle$: dark (red) bars show the fraction of 14 traditional courses ($N = 2084$), and light (green) bars show the fraction of 48 interactive engagement courses ($N = 4458$), both within bins of width $\delta \langle g \rangle = 0.04$ centered on the $\langle g \rangle$ values shown.

III. CONCEPTUAL TEST RESULTS A. Gain vs Pretest Graph - All Data

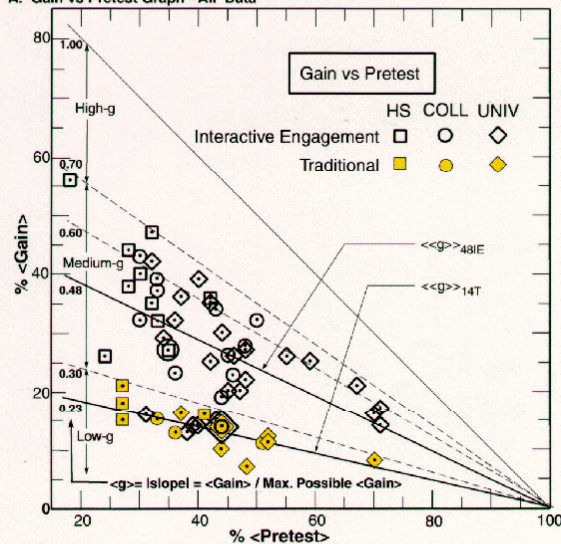


Fig. 1. $\langle g \rangle$ vs $\langle \text{Pretest} \rangle$ score on the conceptual Mechanics Diagnostic (MD) or Force Concept Inventory (FCI) tests for 62 courses enrolling a total $N = 6542$ students: 14 traditional (T) courses ($N = 2084$) which made little or no use of interactive engagement (IE) methods, and 48 IE courses ($N = 4458$) which made considerable use of IE methods. Slope lines for the average of the 14 T courses $\langle\langle g \rangle\rangle_{14T}$ and 48 IE courses $\langle\langle g \rangle\rangle_{48IE}$ are shown, as explained in the text.

Physics (Mechanics) Concepts: The Force Concept Inventory (FCI)

- A 30 item multiple choice test to probe student's understanding of basic concepts in mechanics.
- The choice of topics is based on careful thought about what the fundamental issues and concepts are in Newtonian dynamics.
- Uses common speech rather than cueing specific physics principles.
- The distractors (wrong answers) are based on students' common inferences.

Informal Cooperative Learning Groups

Can be used at any time

Can be short term and ad hoc

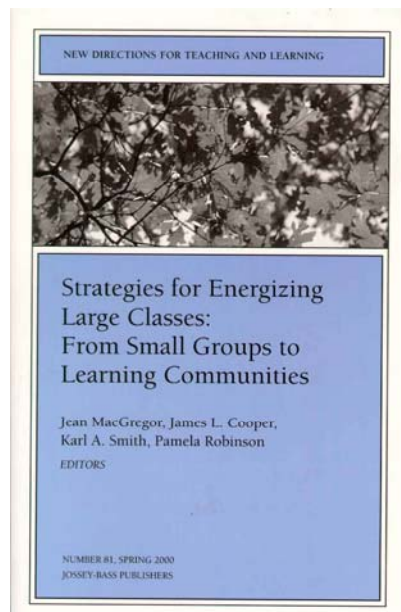
May be used to break up a long lecture

Provides an opportunity for students to process material they have been listening to (Cognitive Rehearsal)

Are especially effective in large lectures

Include "book ends" procedure

Are not as effective as Formal Cooperative Learning or Cooperative Base Groups



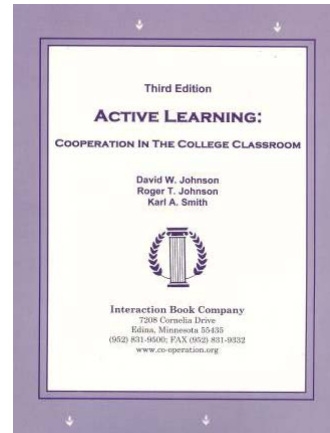
Strategies for Energizing Large Classes: From Small Groups to Learning Communities:

Jean MacGregor,
James Cooper,
Karl Smith,
Pamela Robinson

New Directions for Teaching and Learning,
No. 81, 2000.
Jossey- Bass

Active Learning: Cooperation in the College Classroom

- **Informal** Cooperative Learning Groups
- • **Formal** Cooperative Learning Groups
- Cooperative **Base** Groups



See Cooperative Learning
Handout (CL College-804.doc) 23

Formal Cooperative Learning Task Groups



How Should Colleges Prepare Students To Succeed In Today's Global Economy?

Based On Surveys Among Employers And Recent College Graduates

Conducted On Behalf Of:
The Association Of American Colleges And Universities

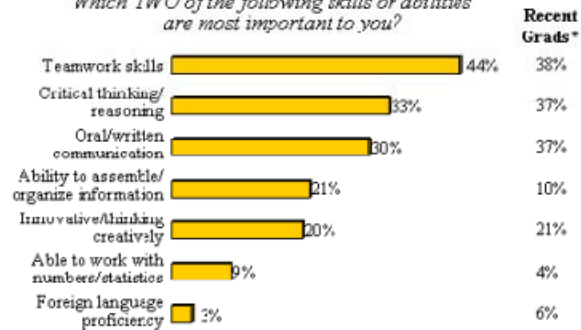
By Peter D. Hart Research Associates, Inc.

December 28, 2006

Peter D. Hart Research Associates, Inc.
1728 Connecticut Avenue, NW
Washington, DC 20009

Most Important Skills Employers Look For In New Hires

Which TWO of the following skills or abilities are most important to you?



* Skills/abilities recent graduates think are the two most important to employers

<http://www.aacu.org/advocacy/leap/documents/Re8097abcombined.pdf>

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Top Three Main Engineering Work Activities

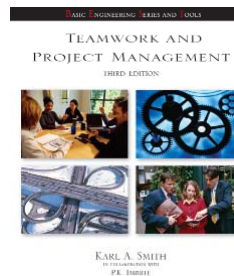
Engineering Total

- Design – 36%
- Computer applications – 31%
- Management – 29%

Civil/Architectural

- Management – 45%
- Design – 39%
- Computer applications – 20%

Burton, L., Parker, L., & LeBold, W. 1998. U.S. engineering career trends. *ASEE Prism*, 7(9), 18-21.



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- Communication
 - Listening and Persuading
- Decision Making
- Conflict Management
- Leadership
- Trust and Loyalty

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1. Specifying Objectives
2. Making Decisions
3. Explaining Task, Positive Interdependence, and Individual Accountability
4. Monitoring and Intervening to Teach Skills
5. Evaluating Students' Achievement and Group Effectiveness

Formal Cooperative Learning – Types of Tasks

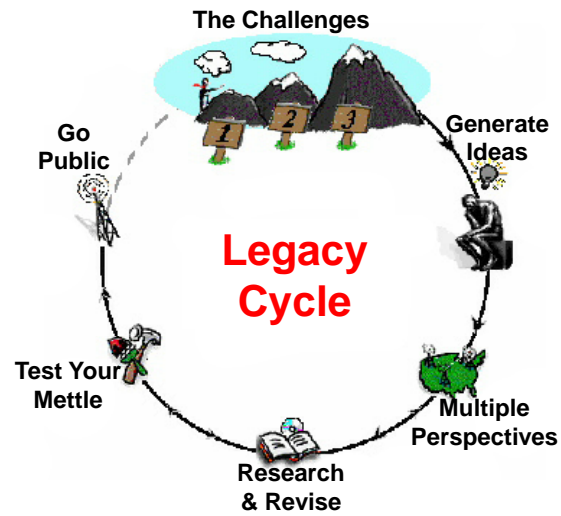
1. Jigsaw – Learning new conceptual/procedural material
2. Peer Composition or Editing
3. Reading Comprehension/Interpretation
4. **Problem Solving, Project, or Presentation**
5. Review/Correct Homework
6. Constructive Academic Controversy
7. Group Tests

Challenge-Based Learning

- Problem-based learning
- Case-based learning
- Project-based learning
- Learning by design
- Inquiry learning
- Anchored instruction

John Bransford, Nancy Vye and Helen Bateman. Creating High-Quality Learning Environments: Guidelines from Research on How People Learn

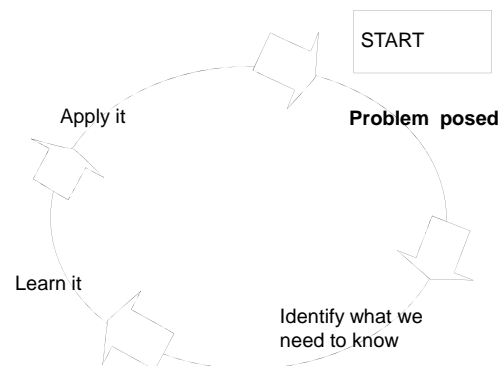
Challenge-Based Instruction with the Legacy Cycle



<https://repo.vanth.org/portal/public-content/star-legacy-cycle/star-legacy-cycle>

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Problem-Based Learning



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Problem-Based Cooperative Learning

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



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

By SARA RIMER

Published: January 12, 2009

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,

COMMENTS (00)

 E-MAIL PRINT SINGLE PAGE

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

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[illegible]

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

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PBL@UD
 Institute for Transforming Undergraduate Education
 Problem-Based Learning at University of Delaware

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The Motivation to Learn Begins with a Problem

In a problem-based learning (PBL) model, students engage complex, challenging problems and collaboratively work toward their resolution. PBL is about students connecting disciplinary knowledge to real-world problems—the motivation to solve a problem becomes the motivation to learn.



What we offer

PBL Clearinghouse

Find great problems for your

In this peer-reviewed online resource, educators have the opportunity to submit and publish their own problems and articles on problem-based learning.

[Learn more](#)

PBL Training at a lower cost:
Attend our January 4-6 Workshop for an Introduction to PBL!

This workshop will demonstrate problem-based learning (PBL) and model ways that PBL can be used effectively in all disciplines. We will begin with a problem, and participants will work in teams to experience first hand what this instructional approach entails. We will then move to the main focus of this program: writing effective problem-based materials. Participants will leave the session with new or revised problems for use in their courses.

[Learn more](#)

PBL@UD

For more than ten years, the Leaders and Fellows of the Institute for Transforming Undergraduate Education (ITUE) have encouraged the adoption of student-centered and active classroom pedagogies—and in particular—the use of PBL in the undergraduate classroom. On- and off-campus workshops are held for faculty and students to enhance their understanding of PBL.

Recipient of a Hesburgh Certificate of Excellence



The Theodore M. Hesburgh Award was created to acknowledge and reward successful, innovative faculty development programs that enhance undergraduate teaching. ITUE is a recipient of the Hesburgh Certificate of Excellence for its work in implementing problem-based learning in the classroom.

<http://www.udel.edu/inst/>

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Problem-Based Cooperative Learning

Karl A. Smith

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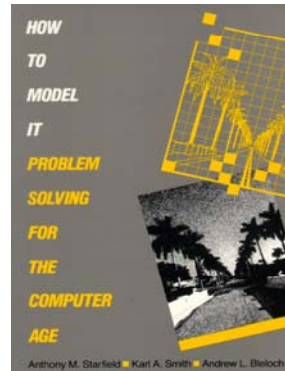
ksmith@umn.edu

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

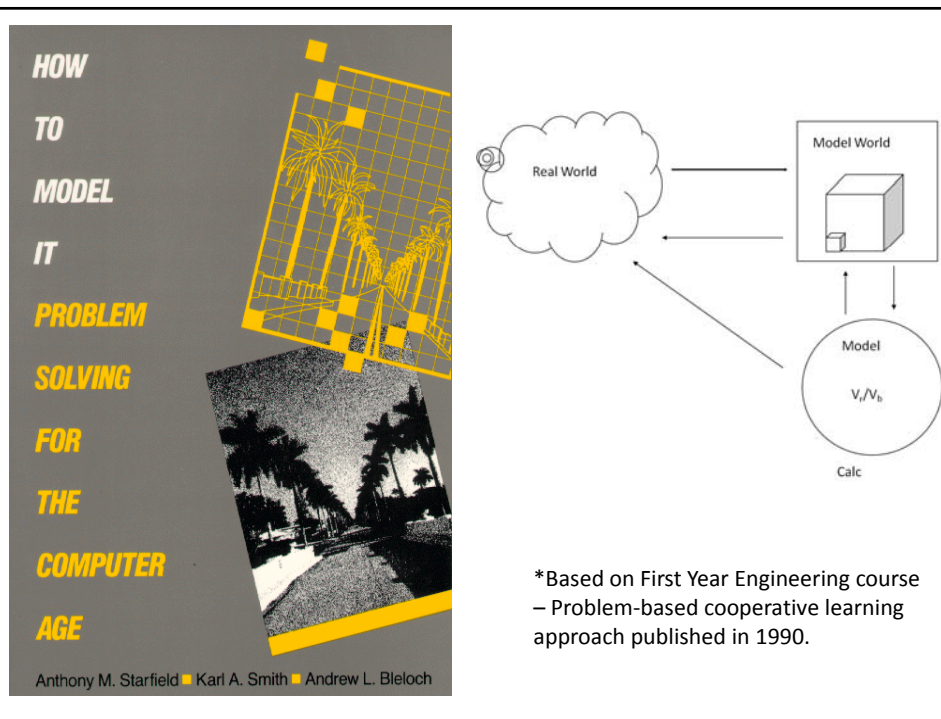
Estimation Exercise

First Course Design Experience UMN – Institute of Technology

- Thinking Like an Engineer
- Problem Identification
- Problem Formulation
- Problem Representation
- Problem Solving



Problem-Based Learning



*Based on First Year Engineering course
– Problem-based cooperative learning
approach published in 1990.

Problem Based Cooperative Learning Format

TASK: Solve the problem(s) or Complete the project.

INDIVIDUAL: Estimate answer. Note strategy.

COOPERATIVE: One set of answers from the group, strive for agreement, make sure everyone is able to explain the strategies used to solve each problem.

EXPECTED CRITERIA FOR SUCCESS: Everyone must be able to explain the strategies used to solve each problem.

EVALUATION: Best answer within available resources or constraints.

INDIVIDUAL ACCOUNTABILITY: One member from your group may be randomly chosen to explain (a) the answer and (b) how to solve each problem.

EXPECTED BEHAVIORS: Active participating, checking, encouraging, and elaborating by all members.

INTERGROUP COOPERATION: Whenever it is helpful, check procedures, answers, and strategies with another group.

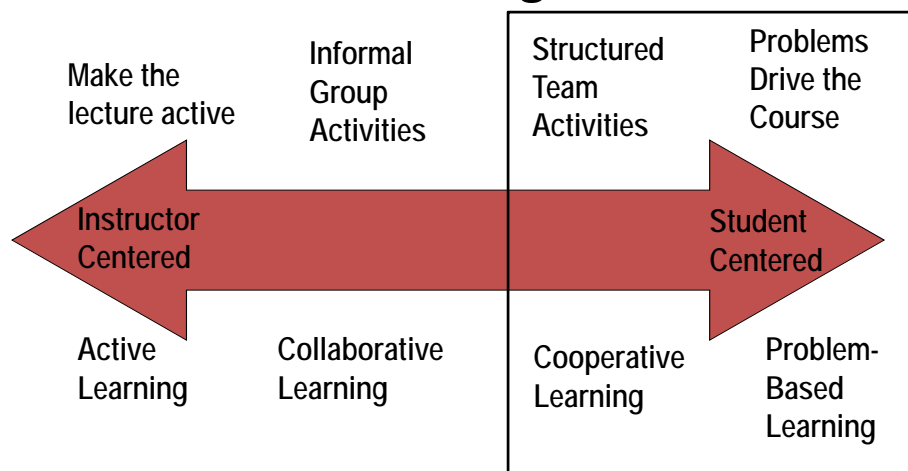
Cooperative Base Groups

- Are Heterogeneous
- Are Long Term (at least one quarter or semester)
- Are Small (3-5 members)
- Are for support
- May meet at the beginning of each session or may meet between sessions
- Review for quizzes, tests, etc. together
- Share resources, references, etc. for individual projects
- Provide a means for covering for absentees

Designing and Implementing Cooperative Learning

- Think like a designer
- Ground practice in robust theoretical framework
- Start small, start early and iterate
- Celebrate the successes; problem-solve the failures

The Active Learning Continuum



Prince, M. (2010). NAE FOEE

*My work is situated here – Cooperative Learning & Challenge-Based Learning

Design and Implementation of Cooperative Learning – Resources

- Design Framework – How People Learn (HPL) & Backward Design Process
 - Streveler, R.A., Smith, K.A. and Pilotte, M. 2011. Aligning Course Content, Assessment, and Delivery: Creating a Context for Outcome-Based Education – <http://www.ce.umn.edu/~smith/links.html>
 - Bransford, Vye & Bateman. 2002. Creating High Quality Learning Environments -- <http://www.telp.edu/openbook/03/0002927.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 – <http://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 [[http://ce.umn.edu/~smith/SocialNatureofLearning.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.htm>
 - Fairweather (2008) Linking Evidence and Promising Practices in Science, Technology, Engineering, and Mathematics (STEM) Undergraduate Education - <http://www.fairweather.com/engr/engr101/engr101resources/engr101resources.pdf>