

Engaging Students Through Active and Cooperative Learning

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Session Goals & Agenda

- Goals & Desired Outcomes
 - Develop rationale for Pedagogies of Engagement
 - Describe key features of cooperative learning approach for engaging students
 - Apply cooperative learning to classroom practice
 - Make connections between cooperative learning and desired outcomes of courses and programs
- Agenda
 - Review/Introduce Cooperative Learning (CL)
 - Key concepts of CL
 - Approaches for implementing CL

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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]

Pedagogies of Engagement



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Pedagogies of Engagement: Classroom-Based Practices

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James Duderstadt
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 Dean, Provost and President of the University of Michigan

Journal of Engineering Education

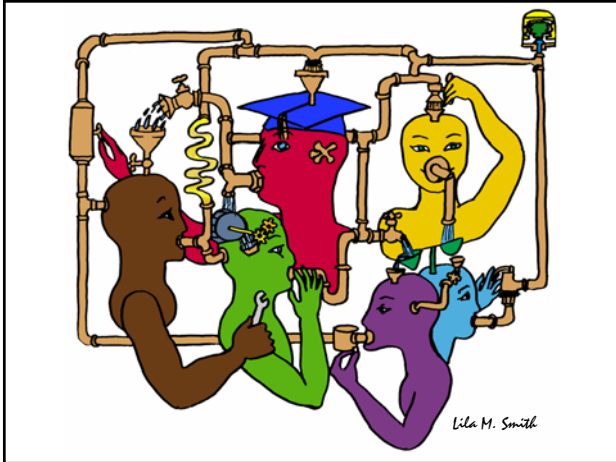
“Throughout the whole enterprise, the core issue, in my view, is the mode of teaching and learning that is practiced. Learning ‘about’ things does not enable students to acquire the abilities and understanding they will need for the twenty-first century. We need new **pedagogies of engagement** that 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)

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Lila M. Smith




Pedago-pathologies

Amnesia

Fantasia

Inertia

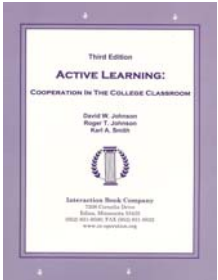


Lee Shulman – MSU Med School – PBL Approach (late 60s – early 70s), Currently President of the Carnegie Foundation for the Advancement of College Teaching

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

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) 9

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

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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.

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

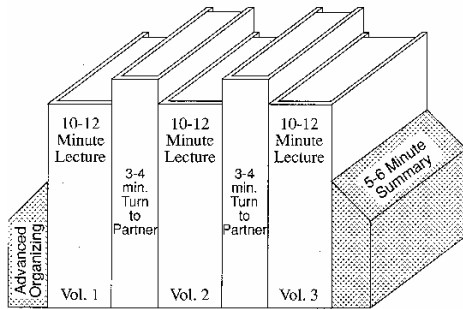
- Positive Interdependence
- Individual and Group Accountability
- Face-to-Face Promotive Interaction
- Teamwork Skills
- Group Processing

Individual & Group Accountability

- Individual evaluation of performance of self and other members
- Instructor design – individual sub tasks
- Letting students decide how to divide up the work, but it makes it harder to hold students accountable
- Individual justification of each member's contribution
- Personal reflection on the group work – how did the idea develop
- Individual quizzes and exams, individual writing
- Individual followed by group quiz or exam

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Book Ends on a Class Session



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 ¹⁹

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.

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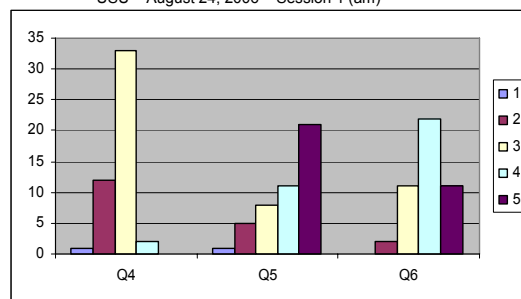
Session Summary (Minute Paper)

Reflect on the session:

1. What were the most important points for you?
2. What is one thing you would be willing to try?
3. What questions do you have?
4. Pace: Too slow 1 5 Too fast
5. Relevance: Little 1 5 Lots
6. Format: Ugh 1 5 Ah

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USU – August 24, 2006 – Session 1 (am)



Q4 – Pace: Too slow 1 5 Too fast
Q5 – Relevance: Little 1 5 Lots
Q6 – Format: Ugh 1 5 Ah

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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

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

Derek Bok Center - www.fas.harvard.edu/~bok_cen/

Richard Hake (Interactive engagement vs traditional methods)
<http://www.physics.indiana.edu/~hake/>

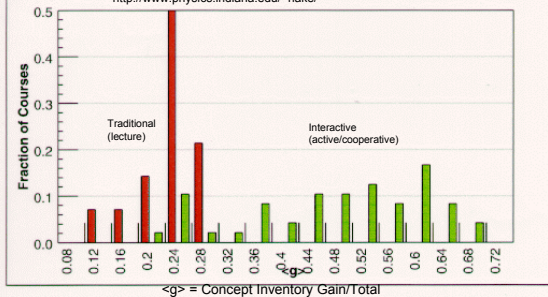
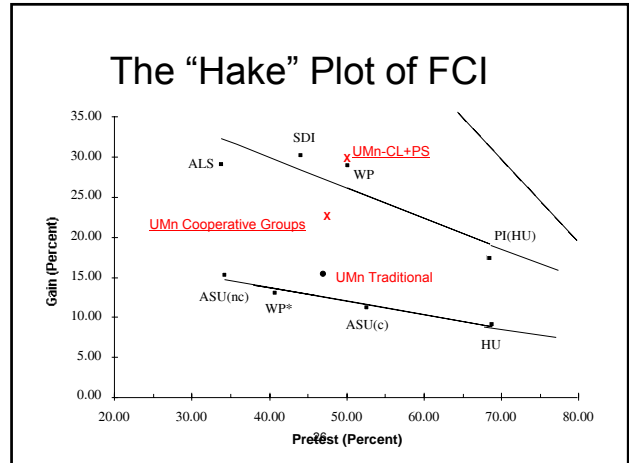
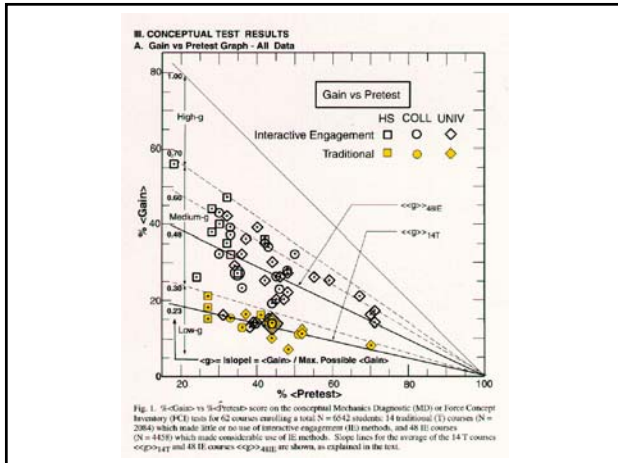


Fig. 2. Histogram of the average normalized gain $\langle g \rangle$: dark (red) bars show the fraction of 14 traditional courses (N = 2084), and light (green) bars show the fraction of 48 interactive engagement courses (N = 4458), both within bins of width $\delta \langle g \rangle = 0.04$ centered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



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.

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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

Active Learning: Cooperation in the College Classroom

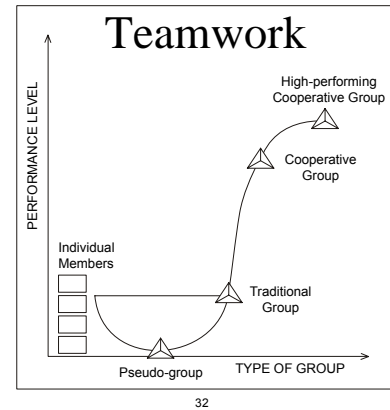
- **Informal** Cooperative Learning Groups
- **Formal** Cooperative Learning Groups
- Cooperative **Base** Groups

See Cooperative Learning Handout (CL College-804.doc) 29

Formal Cooperative Learning Task Groups

Design team failure is usually due to failed team dynamics (Leifer, Koseff & Lenshow, 1995).

It's the soft stuff that's hard, the hard stuff is easy (Doug Wilde, quoted in Leifer, 1997)



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Characteristics of Effective Teams

- ?
- ?

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A team is a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable

- SMALL NUMBER
- COMPLEMENTARY SKILLS
- COMMON PURPOSE & PERFORMANCE GOALS
- COMMON APPROACH
- MUTUAL ACCOUNTABILITY

--Katzenbach & Smith (1993)
The Wisdom of Teams

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
<p>Task Interdependence</p> <ol style="list-style-type: none"> Factorial design Chain reaction <p>Identify Interdependence</p> <p>Mutual identity teams, movies, etc.</p> <p>Resource Interdependence</p> <ol style="list-style-type: none"> Limit resources (one set of materials) Ignore materials Separate Contributions <p>Environmental Interdependence</p> <ol style="list-style-type: none"> Designated discussion space Group has special meeting place <p>Daily Role Interdependence</p> <p>Assign each member a role and rotate these</p> <p>Faculty Interdependence</p> <p>Reciprocal interdependence in situations ("You are a scientist/library/jazz team, but on the same, etc.")</p> <p>Reward/Calculation Interdependence</p> <ol style="list-style-type: none"> Calculate joint scores Rotate points Non-academic rewards (Food, free time, etc.) Single group grade/letter due to all <p>Outside Challenge Interdependence</p> <ol style="list-style-type: none"> Intergroup competition Other class competition <p>Goal Interdependence (reciprocal)</p> <ol style="list-style-type: none"> All students share mastery All members improve All group member scores to get an overall group score One product from groups that all helped with and can explain 	<p>Ways to ensure team fairness:</p> <ul style="list-style-type: none"> Keep group size small Assign roles Randomly select 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 agree: "I participated, I agree, and I can explain the information" Observe & record individual contributions <p>Ways to ensure that all members learn:</p> <ul style="list-style-type: none"> Practice both Ask 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 and lead Simultaneous explaining: each student explains their learning to a new partner
<p>Good Interdependence (reciprocal)</p> <ol style="list-style-type: none"> All students share mastery All members improve All group member scores to get an overall group score One product from groups that all helped with and can explain 	<p>Face-to-Face Interaction</p> <p>Structure:</p> <ul style="list-style-type: none"> 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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Teamwork Skills

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

Cooperative Learning Skills	Working Cooperative Skills
<ul style="list-style-type: none"> 1. Planning Skills 2. Decision Making 3. Problem Solving 4. Conflict Management 5. Leadership 6. Trust and Loyalty 7. Communication 8. Teamwork 9. Accountability 10. Evaluation 	<ul style="list-style-type: none"> 1. Active Listening 2. Active Participation 3. Active Problem Solving 4. Active Conflict Management 5. Active Leadership 6. Active Trust and Loyalty 7. Active Communication 8. Active Teamwork 9. Active Accountability 10. Active Evaluation

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Group Processing Plus/Delta Format

Plus (+) Things That Group Did Well	Delta (Δ) Things Group Could Improve

Professor's Role in Formal Cooperative Learning

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

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Decisions, Decisions

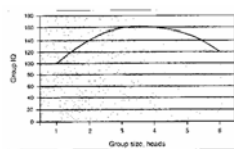
- Group size?
- Group selection?
- Group member roles?
- How long to leave groups together?
- Arranging the room?
- Providing materials?
- Time allocation?

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Formal Cooperative Learning Task Groups



Perkins, David. 2003. *King Arthur's Round Table: How collaborative conversations create smart organizations*. NY: Wiley.



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

Challenged-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*

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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.

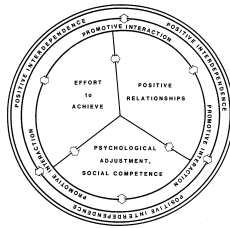
Cooperative Learning Research Support

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



Small-Group Learning: Meta-analysis

Springer, L., Stanne, M. E., & Donovan, S. 1999. Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research*, 69(1), 21-52.

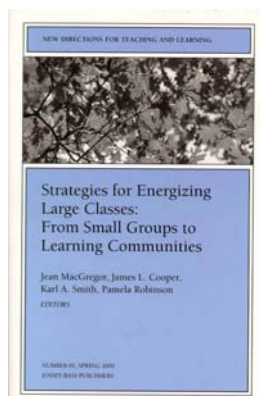
Small-group (predominantly cooperative) learning in postsecondary science, mathematics, engineering, and technology (SMET). 383 reports from 1980 or later, 39 of which met the rigorous inclusion criteria for meta-analysis.

The main effect of small-group learning on achievement, persistence, and attitudes among undergraduates in SMET was significant and positive. Mean effect sizes for achievement, persistence, and attitudes were 0.51, 0.46, and 0.55, respectively.

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



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

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