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

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

“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)
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)

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

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

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

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.

Quick Thinks

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

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

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...


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

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

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

Physics
- Peer Instruction
  - Peer Instruction – www.prenhall.com
  - Richard Hake – http://www.physics.indiana.edu/~hake/

Chemistry
- Chemistry ConceptTests - UW Madison – www.chem.wisc.edu/~concept
- Video: Making Lectures Interactive with ConceptTests
  - ModularChem Consortium – http://mc2.chem.berkeley.edu/
- STEMTEC

Harvard
- Thinking Together & From Questions to Concepts Interactive Teaching in Physics: Derek Bok Center – www.fas.harvard.edu/~bok_cen/
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

Active Learning: Cooperation in the College Classroom

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

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)

Characteristics of Effective Teams

• 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
Teamwork Skills

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

Group Processing
Plus/Delta Format

<table>
<thead>
<tr>
<th>Plus (+)</th>
<th>Delta (Δ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Things Group Did Well</td>
<td>Things Group Could Improve</td>
</tr>
</tbody>
</table>

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

Decisions, Decisions

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

Formal Cooperative Learning Task Groups

- Jigsaw – Learning new conceptual/procedural material
- Peer Composition or Editing
- Reading Comprehension/Interpretation
- Problem Solving, Project, or Presentation
- Review/Correct Homework
- Constructive Academic Controversy
- 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

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:** Wherever it is helpful, check procedures, answers, and strategies with another group.

Cooperative Learning Research Support


- 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


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.

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