Formal Cooperative Learning – Design, Implementation and Assessment

Karl A. Smith
Engineering Education – Purdue University
STEM Education Center/Civil Eng – University of Minnesota
ksmith@umn.edu - http://www.ce.umn.edu/~smith/

Teaching and Learning Center
King Fahd University of Petroleum and Minerals
26 August 2012

Session Layout

• Welcome & Overview
• Pedagogies of Engagement – Cooperative Learning and Challenge Based Learning
  – Informal Cooperative Learning – Bookends on a Class Session
  – Formal Cooperative Learning
• Design and Implementation
Participant Learning Goals (Objectives)

- Describe key features of Cooperative Learning
- Explain rationale for Pedagogies of Engagement, especially Cooperative Learning & Challenge Based Learning
- Describe key features of the Understanding by Design and How People Learn
- Apply cooperative learning to classroom practice
- Identify connections between cooperative learning and desired outcomes of courses and programs

Reflection and Dialogue

- Individually reflect on your practice of Formal Cooperative Learning, especially Challenge-Based Learning (Case, Problem, Project). Write for about 1 minute
  - Key ideas, insights, applications – Success Stories
  - Questions, concerns, challenges
- Discuss with your neighbor for about 2 minutes
  - Select one Insight, Success Story, Comment, Question, etc. that you would like to present to the whole group if you are randomly selected
Pedagogies of Engagement

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)
Formal Cooperative Learning

Task Groups

Most Important Skills Employers Look For In New Hires

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

<table>
<thead>
<tr>
<th>Skill</th>
<th>Recent Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork skills</td>
<td>64%</td>
</tr>
<tr>
<td>Critical thinking</td>
<td>27%</td>
</tr>
<tr>
<td>Oral/written communication</td>
<td>30%</td>
</tr>
<tr>
<td>Ability to assemble/organize information</td>
<td>11%</td>
</tr>
<tr>
<td>Innovative thinking</td>
<td>20%</td>
</tr>
<tr>
<td>Able to work with mathematics/statistics</td>
<td>3%</td>
</tr>
<tr>
<td>Foreign language proficiency</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>6%</td>
</tr>
</tbody>
</table>

* Skill(s) indicated most frequently by both employers and the two most important to employers.
Teamwork Skills

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

Top Three Main Engineering Work Activities

**Engineering Total**

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

**Civil/Architectural**

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

Characteristics of Effective Teams?

•?
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*

---

**Six Basic Principles of Team Discipline**

- Keep membership small
- Ensure that members have complimentary skills
- Develop a common purpose
- Set common goals
- Establish a commonly agreed upon working approach
- Integrate mutual and individual accountability

Katzenbach & Smith (2001) *The Discipline 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


Hackman – Leading Teams

• Real Team
• Compelling Direction
• Enabling Structure
• Supportive Organizational Context
• Available Expert Coaching

Team Diagnostic Survey (TDS)

https://research.wjh.harvard.edu/TDS/
Real Team

• clear boundaries
• team members are interdependent for some common purpose, producing a potentially assessable outcome for which members bear collective responsibility
• at least moderate stability of membership

Compelling Direction

• Good team direction is:
  – challenging (which energizes members)
  – clear (which orients them to their main purposes)
  – consequential (which engages the full range of their talents)
Enabling Structure

• Key structural features in fostering competent teamwork
  – Task design: The team task should be well aligned with the team's purpose and have a high standing on “motivating potential.”
  – Team composition: The team size should be as small as possible given the work to be accomplished, should include members with ample task and interpersonal skills, and should consist of a good diversity of membership
  – Core norms of conduct: Team should have established early in its life clear and explicit specification of the basic norms of conduct for member behavior.

<table>
<thead>
<tr>
<th>Group Task Roles</th>
<th>Group Maintenance Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiating</td>
<td>Encouraging</td>
</tr>
<tr>
<td>Seeking Information</td>
<td>Expressing Feelings</td>
</tr>
<tr>
<td>Giving Information</td>
<td>Harmonizing</td>
</tr>
<tr>
<td>Seeking Opinions</td>
<td>Compromising</td>
</tr>
<tr>
<td>Giving Opinions</td>
<td>Facilitating Communications</td>
</tr>
<tr>
<td>Clarifying</td>
<td>Setting Standards or Goals</td>
</tr>
<tr>
<td>Elaborating</td>
<td>Testing Agreement</td>
</tr>
<tr>
<td>Summarizing</td>
<td>Following</td>
</tr>
</tbody>
</table>
Group Processing
Plus/Delta Format

Plus (+)
Things That Group Did Well

Delta (Δ)
Things Group Could Improve

Team Charter

- Team name, membership, and roles
- Team Mission Statement
- Anticipated results (goals)
- Specific tactical objectives
- **Ground rules/Guiding principles for team participation**
- Shared expectations/aspirations
Code of Cooperation

• EVERY member is responsible for the team’s progress and success.
• Attend all team meetings and be on time.
• Come prepared.
• Carry out assignments on schedule.
• Listen to and show respect for the contributions of other members; be an active listener.
• CONSTRUCTIVELY criticize ideas, not persons.
• Resolve conflicts constructively.
• Pay attention, avoid disruptive behavior.
• Avoid disruptive side conversations.
• Only one person speaks at a time.
• Everyone participates, no one dominates.
• Be succinct, avoid long anecdotes and examples.
• No rank in the room.
• Respect those not present.
• Ask questions when you do not understand.
• Attend to your personal comfort needs at any time but minimize team disruption.
• HAVE FUN!!
•?

Adapted from Boeing Aircraft Group Team Member Training Manual

Ten Commandments: An Affective Code of Cooperation

• Help each other be right, not wrong.
• Look for ways to make new ideas work, not for reasons they won’t.
• If in doubt, check it out! Don't make negative assumptions about each other.
• Help each other win, and take pride in each other's victories.
• Speak positively about each other and about your organization at every opportunity.
• Maintain a positive mental attitude no matter what the circumstances.
• Act with initiative and courage, as if it all depends on you.
• Do everything with enthusiasm; it's contagious.
• Whatever you want; give it away.
• Don't lose faith.
• Have fun

Ford Motor Company
Team Charter Examples & Research

- Team Charter – Developed by Vivian Corwin and Marilyn A. Uy for COM 321 (Organizational Behaviour) Gustavson School of Business, University of Victoria
- Group Ground Rules Contract Form – Developed by Deborah Allan, University of Delaware
Group Ground Rules Contract Form

(Adapted from a form developed by Dr. Deborah Allen, University of Delaware)

Project groups are an effective aid to learning, but to work best they require that all group members clearly understand their responsibilities to one another. These project group ground rules describe the general responsibilities of every member to the group. You can adopt additional ground rules if your group believes they are needed. Your signature on this contract form signifies your commitment to adhere to these rules and expectations.

All group members agree to:
1. Come to class and team meetings on time.
2. Come to class and team meetings with assignments and other necessary preparations done.

Additional ground rules:
1. 
2. 

If a member of the project team repeatedly fails to meet these ground rules, other members of the group are expected to take the following actions:

Step 1: (fill in this step with your group)

If not resolved:
Step 2: Bring the issue to the attention of the teaching team.
If not resolved:
Step 3: Meet as a group with the teaching team.

The teaching team reserves the right to make the final decisions to resolve difficulties that arise within the groups. Before this becomes necessary, the team should try to find a fair and equitable solution to the problem.

Member’s Signature: Group Number:______________
1.____________________________ 27
2.____________________________ 4
3.____________________________

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

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

Legacy Cycle

https://repo.vanth.org/portal/public-content/star-legacy-cycle/star-legacy-cycle
Problem-Based Learning

Apply it

Problem posed

Learn it

Identify what we need to know

Problem-Based Cooperative Learning

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

CAMBRIDGE, Mass. — For as long as anyone can remember, introductory physics at the Massachusetts Institute of Technology was taught in a vast windowsless amphitheater known by its number,
http://web.mit.edu/edtech/casestudies/teal.html#video

http://www.ncsu.edu/PER/scaleup.html
http://mediamill.cla.umn.edu/mediamill/embed/78755


http://www.youtube.com/watch?v=lfT_hoiuY8w

http://youtu.be/lfT_hoiuY8w

http://www.udel.edu/inst/
Leading with TeamLEAD: An Innovative Curriculum at Duke-NUS

- Called TeamLEAD (learn, engage, apply, develop), the method is a radical departure from traditional lecture-based teaching formats. Instead, students are responsible for learning the bulk of the material before class, using recorded lectures from Duke University School of Medicine along with reading assignments from textbooks and medical journals.
- Once in class, they are tested both individually and in small groups, so instructors can focus the rest of the session on areas of weakness. The teams then work together, with “open-book” access to medical references, to solve clinically oriented questions related to the material.
- “The best doctor is no longer the doctor with the best memory,” says Robert Kamei, MD, vice dean for education at Duke-NUS. “In an age when information is available anywhere, instantaneously, we want to provide students with the skills they’ll need in the future -- the ability to find the latest information and apply it to clinical practice.
- To succeed at the highest level, they need to be able to both work in teams and provide leadership, so our curricular approach focuses on developing those abilities, not just rote memorization.”
- Although the concept of team-based learning was introduced in business schools in the 1980s, TeamLEAD is the first time it has been adapted for medical education. 

http://www.youtube.com/watch?v=gW_M426V2E0&feature=related

http://www.youtube.com/watch?v=BlVPLYGdBLg
Problem-Based Cooperative Learning

Karl A. Smith
Engineering Education – Purdue University
Civil Engineering - University of Minnesota
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
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 Instructor's Role in Cooperative Learning

Make Pre-Instructional Decisions

Identifying and Setting Goals: Objectives
- Define the learning outcomes for students and groups.
- Design meaningful tasks for student groups.
- Establish clear criteria for success.
- Allocate time for group activities.
- Plan for group interactions and discussions.

Selecting Appropriate Strategies
- Choose strategies that align with the learning objectives.
- Consider the group size and composition.
- Decide on the use of cooperative learning strategies.

Deciding on Group Size
- Opt for groups of four or six students.
- Ensure that groups are heterogeneous in terms of skills and abilities.
- Consider the dynamics and interactions within the group.

Designing Group Compositions
- Balance the composition to ensure equitable participation.
- Assign roles to students to promote accountability and responsibility.
- Ensure that group members have complementary skills.

Allocating Roles
- Assign roles based on students' strengths and weaknesses.
- Rotate roles to ensure equitable participation.
- Ensure that all students have an opportunity to lead.

Arranging the Room
- Organize the physical space to facilitate group interaction.
- Consider the layout that supports group dynamics.

Plan Materials
- Prepare materials that support group learning and interaction.
- Ensure that materials are accessible to all group members.

Explain Task And Cooperative Structure

Identifying Tasks
- Clarify the tasks and objectives.
- Ensure that tasks are challenging and achievable.

Interact With Students
- Engage with students to monitor their progress.
- Provide feedback and guidance.

Facilitate Group Interactions
- Encourage students to communicate and collaborate.
- Facilitate group discussions and peer interactions.

Evaluate and Process

Evaluate Students
- Assess students' contributions to group discussions.
- Provide constructive feedback.

Classroom Observation
- Observe students' behaviors and interactions.
- Note areas of strength and improvement.

Cooperative Lesson Planning Form

Cooperative Lesson Planning Form

Lesson Title

Objectives

Social Skills

Pre-instructional Decisions

Group Size and Method Of Organizing Groups

Role

Materials

- One Copy Per Group

- One Copy Per Person

Idea Banks

- Opinion

- Question

Explain Task And Cooperative Goal Structure

1. Task

2. Criteria For Success

3. Positive Interdependence

4. Individual Accountability

5. Group Processing

6. Expectations

Monitoring And Interfering

1. Observation Procedure

2. Observation By

3. Intervention For Task Assistance

4. Intervention For Task Failure Assistance

Evaluating And Processing

1. Assessment Of Each Individual Learning

2. Assessment Of Group Productivity

3. Small Group Processing

4. Whole Class Processing

5. Class And Group Goals

6. Process Feedback And Fair Review

- Goal Setting For Improvement

- Celebration

- Other
Design and Implementation of Cooperative Learning – Resources

- Design Framework – How People Learn (HPL) & Backward Design Process
  - Pellegrino – Rethinking and redesigning curriculum, instruction and assessment: What contemporary research and theory suggests --

- Content Resources

- Cooperative Learning - Instructional Format explanation and exercise to model format and to engage workshop participants
  - Cooperative Learning (Johnson, Johnson & Smith)
  - Smith web site --

- Other Resources
  - University of Delaware PBL web site – www.udel.edu/pbl