Design and Implementation of Cooperative Learning

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

Workshop for the Associated Colleges of the St. Lawrence Valley

November 6, 2010

Workshop Layout

- Welcome & Overview
- Integrated Course Design (CAP Model)
  - Content
  - Assessment
  - Pedagogy
- Cooperative Learning
  - Informal – Bookends on a Class Session
  - Formal Cooperative Learning
    - Problem-Based Cooperative Learning
- Develop an Application
- Wrap-up and Next Steps

Workshop Objectives

- Participants will learn about the instructor's role in designing, structuring, and implementing cooperative learning. Specific learning outcomes include:
  - Describe key features of the Content (outcomes) – Assessment – Pedagogy Integrated Design Approach
  - Develop/refine rationale for Cooperative Learning
  - Describe key features of cooperative learning
  - Apply cooperative learning to classroom practice
  - Make connections between cooperative learning and desired outcomes of courses and programs

Background Knowledge Survey

- Familiarity with
  - Cooperative Learning Strategies
    - Informal – turn-to-your-neighbor
    - Formal – cooperative problem-based learning
  - Approaches to Course Design
    - Wiggins & McTighe – Understanding by Design (Backward Design)
    - Fink – Creating Significant Learning Experiences
    - Felder & Brent – Effective Course Design
  - Research
    - Student engagement – NSSE
    - Cooperative learning
    - *How People Learn*
- Responsibility
  - Individual course
  - Program
  - Accreditation
  - Other

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]

Integrated Course Design Model

- *Understanding By Design* - Backward Design Approach – Course, Class Session, and Learning Module Design: From Objectives and Evidence to Instruction (Wiggins & McTighe, 1998 and Bransford, Vye & Bateman, 2002)
- Curriculum-Instruction-Assessment Triad (Pellegrino, 2006)

Some Important Principles About Learning and Understanding

The first important principle about how people learn is that **students come to the classroom with preconceptions** about how the world works which include beliefs and prior knowledge acquired through various experiences.

The second important principle about how people learn is that **to develop competence in an area of inquiry, students must**: (a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of a conceptual framework, and (c) organize knowledge in ways that facilitate retrieval and application.

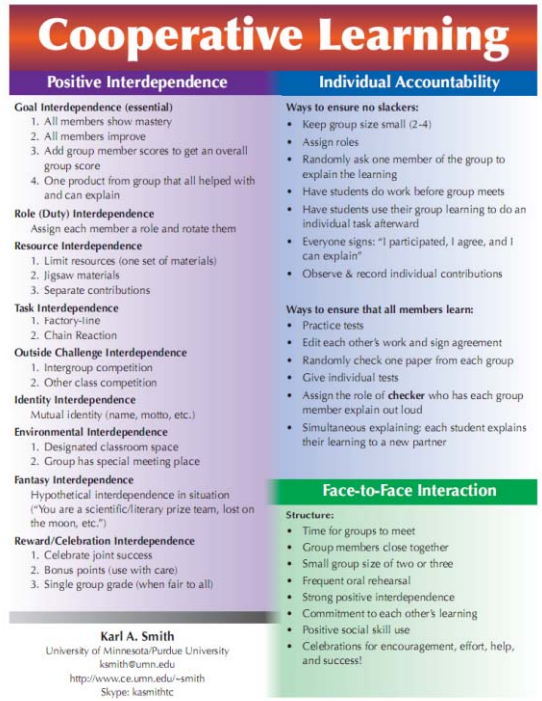
A third critical idea about how people learn is that **a "metacognitive" approach to instruction can help students** learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them.

Jim Pellegrino (2006) – Rethinking and redesigning curriculum, instruction and assessment: What contemporary research and theory suggests. http://www.skillscommission.org/commissioned.htm

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



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1. Factory-line
2. Chain Reaction

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1. Intergroup competition
2. Other class competition

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Mutual identity (name, motto, etc.)

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

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1. Celebrate joint success
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- Practice tests
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- Randomly check one paper from each group
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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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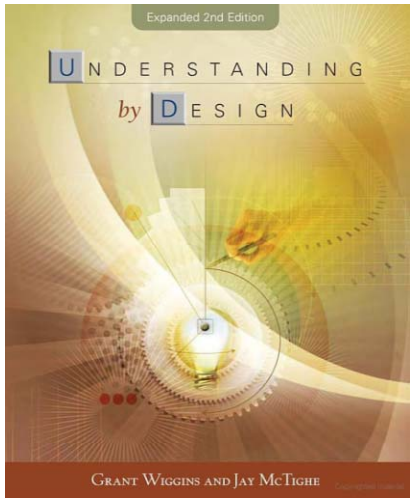
Skype: kasmithtc

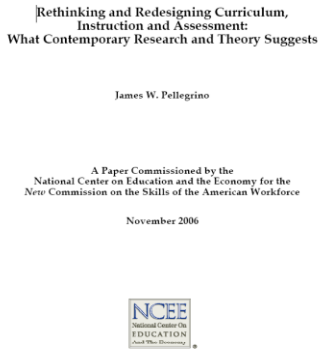
Reflection and Dialogue

- Individually reflect on your familiarity with (1) Integrated Course Design and (2) Cooperative Learning. Write for about 1 minute
  - Key ideas, insights, applications – Success Stories
  - Questions, concerns, challenges
- Discuss with your neighbor for about 3 minutes
  - Select one Insight, Success Story, Comment, Question, etc. that you would like to present to the whole group if you are randomly selected
- Whole group discussion

Key Resources



http://books.google.com/books?id=N2EfKlyUN4QC&printsec=frontcover&source=gbs_v2_summary_r&cad=0#v=onepage&q=&f=false


Rethinking and Redesigning Curriculum, Instruction and Assessment: What Contemporary Research and Theory Suggests

James W. Pellegrino

A Paper Commissioned by the National Center on Education and the Economy for the *New* Commission on the Skills of the American Workforce

November 2006

NCEE National Center On EDUCATION And The Economy

- Wiggins & McTighe – Understanding by Design
- Pellegrino – Rethinking and Redesigning Curriculum, Instruction and Assessment

http://www.skillscommission.org/commissioned.htm

Backward Design Approach
Wiggins & McTighe

Stage 1. Identify Desired Results

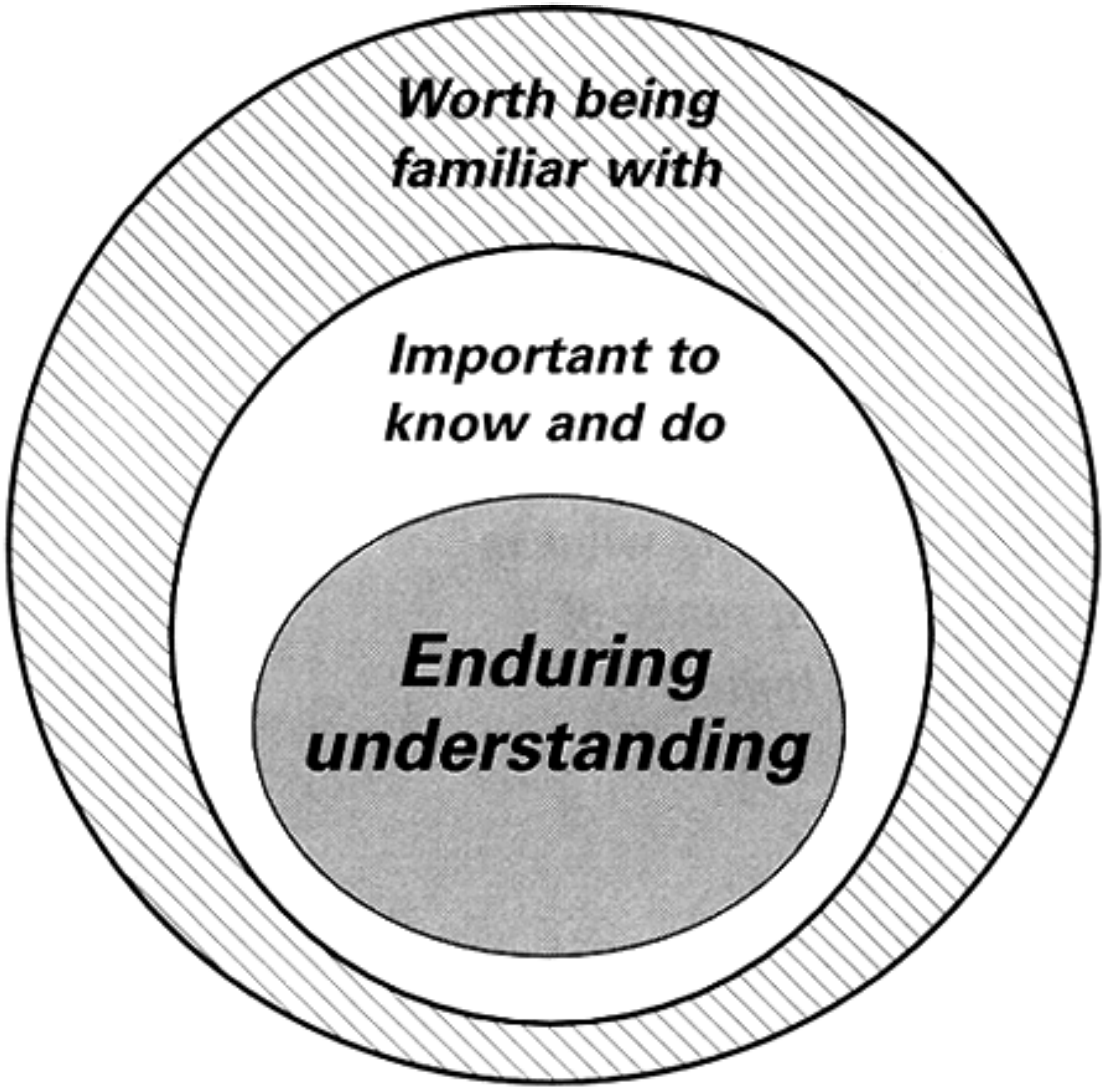
- Enduring understanding
- Important to know and do
- Worth being familiar with

Stage 2. Determine Acceptable Evidence

Stage 3. Plan Learning Experiences and Instruction

From: Wiggins, Grant and McTighe, Jay. 1998. *Understanding by Design*. Alexandria, VA: ASCD

Establishing Curricular Priorities

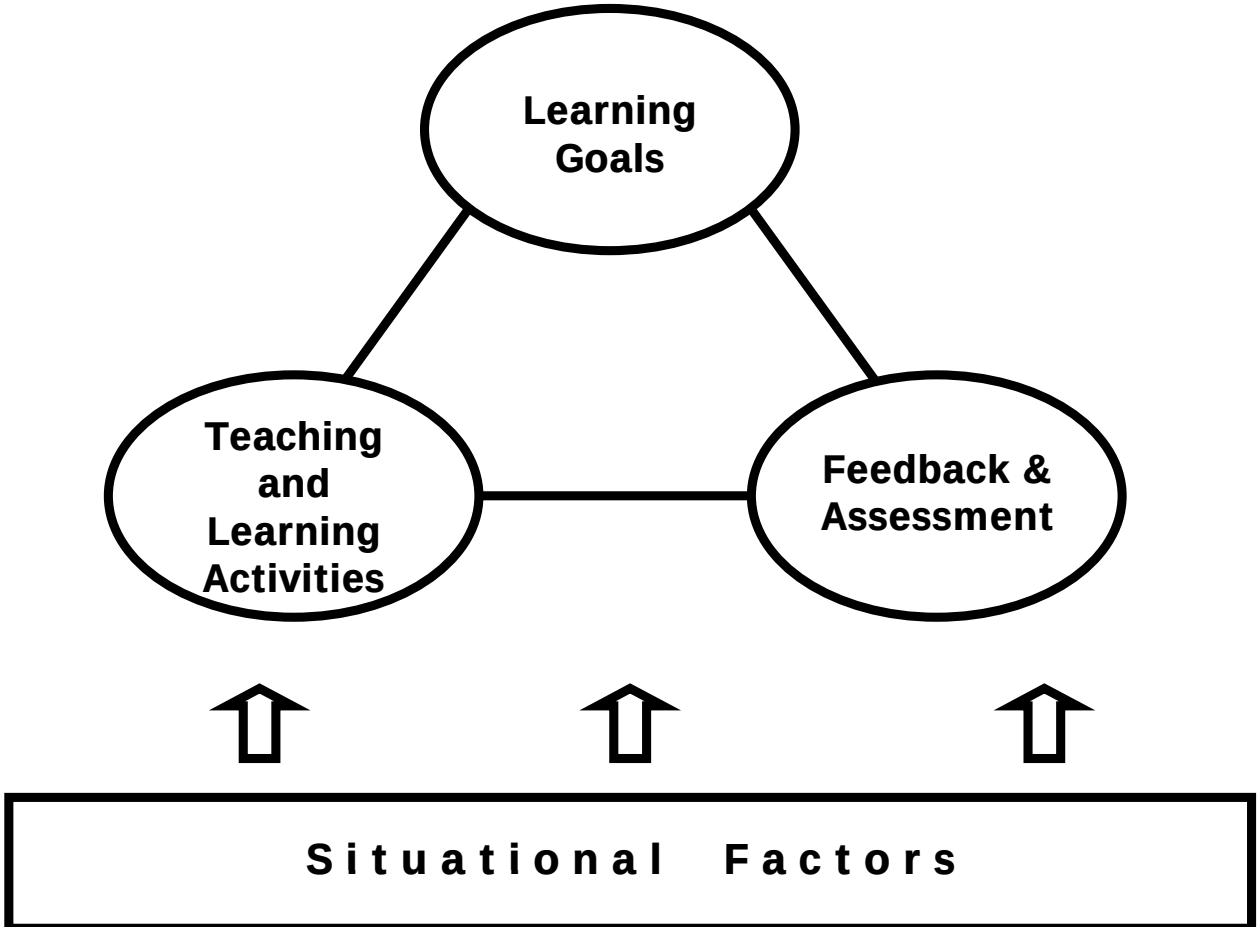


Related Integrated Course Design Model

- Fink, L.D. 2003. *Creating significant learning experiences: An integrated approach to designing*. Jossey-Bass
- Fink, L.D. 2003. A Self-Directed Guide to Designing Courses for Significant Learning. http://www.deefinkandassociates.com/GuidetoCourseDesignAug05.pdf

Model 1

The Key Components Of INTEGRATED COURSE DESIGN



A Self-Directed Guide to Designing Courses for Significant Learning

L. Dee Fink. 2003. *Creating significant learning experiences*. Jossey-Bass.

Backward Design

Stage 1. Identify Desired Results

Filter 1. To what extent does the idea, topic, or process represent a big idea or having enduring value beyond the classroom?

Filter 2. To what extent does the idea, topic, or process reside at the heart of the discipline?

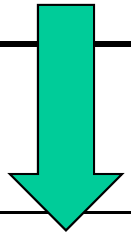
Filter 3. To what extent does the idea, topic, or process require uncoverage?

Filter 4. To what extent does the idea, topic, or process offer potential for engaging students?

Worksheet 1

Worksheet for Designing a Course / Class Session / Learning Module

	Ways of Assessing	Actual Teaching-Learning	Helpful Resources:
Learning Goals for Course/Session/Learning Module:	**This Kind of Learning:**	**Activities:**	(e.g., people, things)
1.			
2.			
3.			
4.			
5.			
6.			



Backward Design

Stage 2. **Determine Acceptable Evidence**

Types of Assessment

Quiz and Test Items:

Simple, content-focused test items

Academic Prompts:

Open-ended questions or problems that require the student to think critically

Performance Tasks or Projects:

Complex challenges that mirror the issues or problems faced by graduates, they are authentic

Taxonomies of Types of Learning

Bloom's taxonomy of educational objectives: Cognitive Domain (Bloom & Krathwohl, 1956)

A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives (Anderson & Krathwohl, 2001).

Facets of understanding (Wiggins & McTighe, 1998)

Taxonomy of significant learning (Fink, 2003)

Evaluating the quality of learning: The SOLO taxonomy (Biggs & Collis, 1982)

The Six Major Levels of Bloom's Taxonomy of the Cognitive Domain (with representative behaviors and sample objectives)

Knowledge. Remembering information *Define, identify, label, state, list, match*

- Identify the standard peripheral components of a computer
- Write the equation for the Ideal Gas Law

Comprehension. Explaining the meaning of information *Describe, generalize, paraphrase, summarize, estimate*

- In one sentence explain the main idea of a written passage
- Describe in prose what is shown in graph form

Application. Using abstractions in concrete situations *Determine, chart, implement, prepare, solve, use, develop*

- Using principles of operant conditioning, train a rate to press a bar
- Derive a kinetic model from experimental data

Analysis. Breaking down a whole into component parts *Points out, differentiate, distinguish, discriminate, compare*

- Identify supporting evidence to support the interpretation of a literary passage
- Analyze an oscillator circuit and determine the frequency of oscillation

Synthesis. Putting parts together to form a new and integrated whole *Create, design, plan, organize, generate, write*

- Write a logically organized essay in favor of euthanasia
- Develop an individualized nutrition program for a diabetic patient

Evaluation. Making judgments about the merits of ideas, materials, or phenomena *Appraise, critique, judge, weigh, evaluate, select*

- Assess the appropriateness of an author's conclusions based on the evidence given
- Select the best proposal for a proposed water treatment plant

The Cognitive Process Dimension

The Knowledge Dimension

	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge – The basic elements that students must know to be acquainted with a discipline or solve problems in it. a. Knowledge of terminology b. Knowledge of specific details and elements						
Conceptual Knowledge – The interrelationships among the basic elements within a larger structure that enable them to function together. a. Knowledge of classifications and categories b. Knowledge of principles and generalizations c. Knowledge of theories, models, and structures						
Procedural Knowledge – How to do something; methods of inquiry, and criteria for using skills, algorithms, techniques, and methods. a. Knowledge of subject-specific skills and algorithms b. Knowledge of subject-specific techniques and methods c. Knowledge of criteria for determining when to use appropriate procedures						
Metacognitive Knowledge – Knowledge of cognition in general as well as awareness and knowledge of one's own cognition. a. Strategic knowledge b. Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge c. Self-knowledge						

(Anderson & Krathwohl, 2001).

The Cognitive Process Dimension

Remember	Understand	Apply	Analyze	Evaluate	Create
Retrieving relevant knowledge from long-term memory	Determining the meaning of instructional messages, including oral, written, and graphic communication.	Carrying out or using a procedure in a given situation	Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose	Making judgments based on criteria and standards	Putting elements together to form a novel, coherent whole or make an original product
Recall Define Relate Review	Restate Describe Identify Express	Employ Translate Demonstrate Examine	Distinguish Compare Contrast Deduce	Select Defend Interpret Discriminate	Arrange Combine Construct Propose

The Knowledge Dimension

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Metacognitive Knowledge – Knowledge of cognition in general as well as awareness and knowledge of one's own cognition.

a. Strategic knowledge

b. Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge

c. Self-knowledge

Facets of Understanding
Wiggins & McTighe, 1998, page 44

When we truly *understand*, we

*Can **explain - cognitive***

*Can **interpret - cognitive***

Can ***apply - cognitive***

Have ***perspective - affective***

Can ***empathize - affective***

Have ***self-knowledge - metacognitive***

Dee Fink – Creating Significant Learning Experiences

A TAXONOMY OF SIGNIFICANT LEARNING

Cognitive

1. Foundational Knowledge

- "Understand and remember" learning

  For example: facts, terms, formulae, concepts, principles, etc.

2. Application

- Thinking: critical, creative, practical (problem-solving, decision-making)
- Other skills

  For example: communication, technology, foreign language
- Managing complex projects

3. Integration

- Making "connections" (i.e., finding similarities or interactions) . . .

  Among: ideas, subjects, people

Affective

4. Human Dimensions

- Learning about and changing one's SELF
- Understanding and interacting with OTHERS

5. Caring

- Identifying/changing one's feelings, interests, values

Meta

6. Learning How to Learn

- Becoming a better student
- Learning how to ask and answer questions
- Becoming a self-directed learner

SOLO Taxonomy

- The **Structure of Observed Learning Outcome** (**SOLO**) model consists of 5 levels of understanding

Surface Learning

  - **Pre-structural** - The task is not attacked appropriately; the student hasn't really understood the point and uses too simple a way of going about it.
  - **Uni-structural** - The student's response only focuses on one relevant aspect.
  - **Multi-structural** - The student's response focuses on several relevant aspects but they are treated independently and additively. Assessment of this level is primarily quantitative.

Deep Learning

  - **Relational** - The different aspects have become integrated into a coherent whole. This level is what is normally meant by an adequate understanding of some topic.
  - **Extended abstract** - The previous integrated whole may be conceptualised at a higher level of abstraction and generalised to a new topic or area.

http://en.wikipedia.org/wiki/Structure_of_Observed_Learning_Outcome

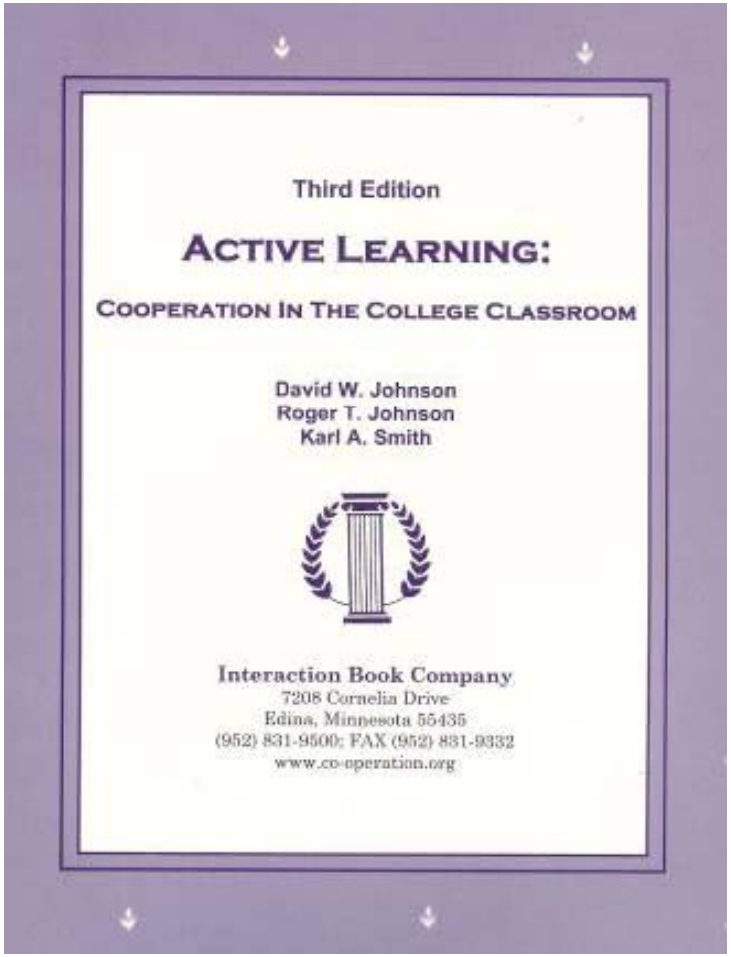
Backward Design

Stage 3. Plan Learning Experiences & Instruction

- What enabling knowledge (facts, concepts, and principles) and skills (procedures) will students need to perform effectively and achieve desired results?
- What activities will equip students with the needed knowledge and skills?
- What will need to be taught and coached, and how should it be taught, in light of performance goals?
- What materials and resources are best suited to accomplish these goals?
- Is the overall design coherent and effective?

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)

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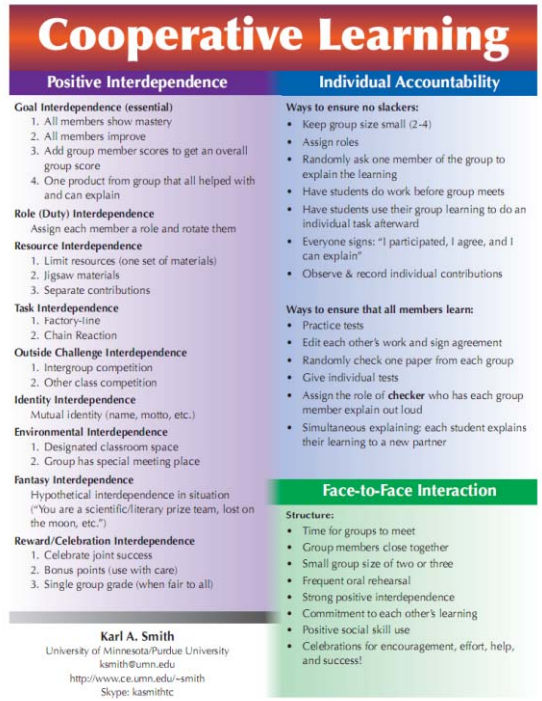

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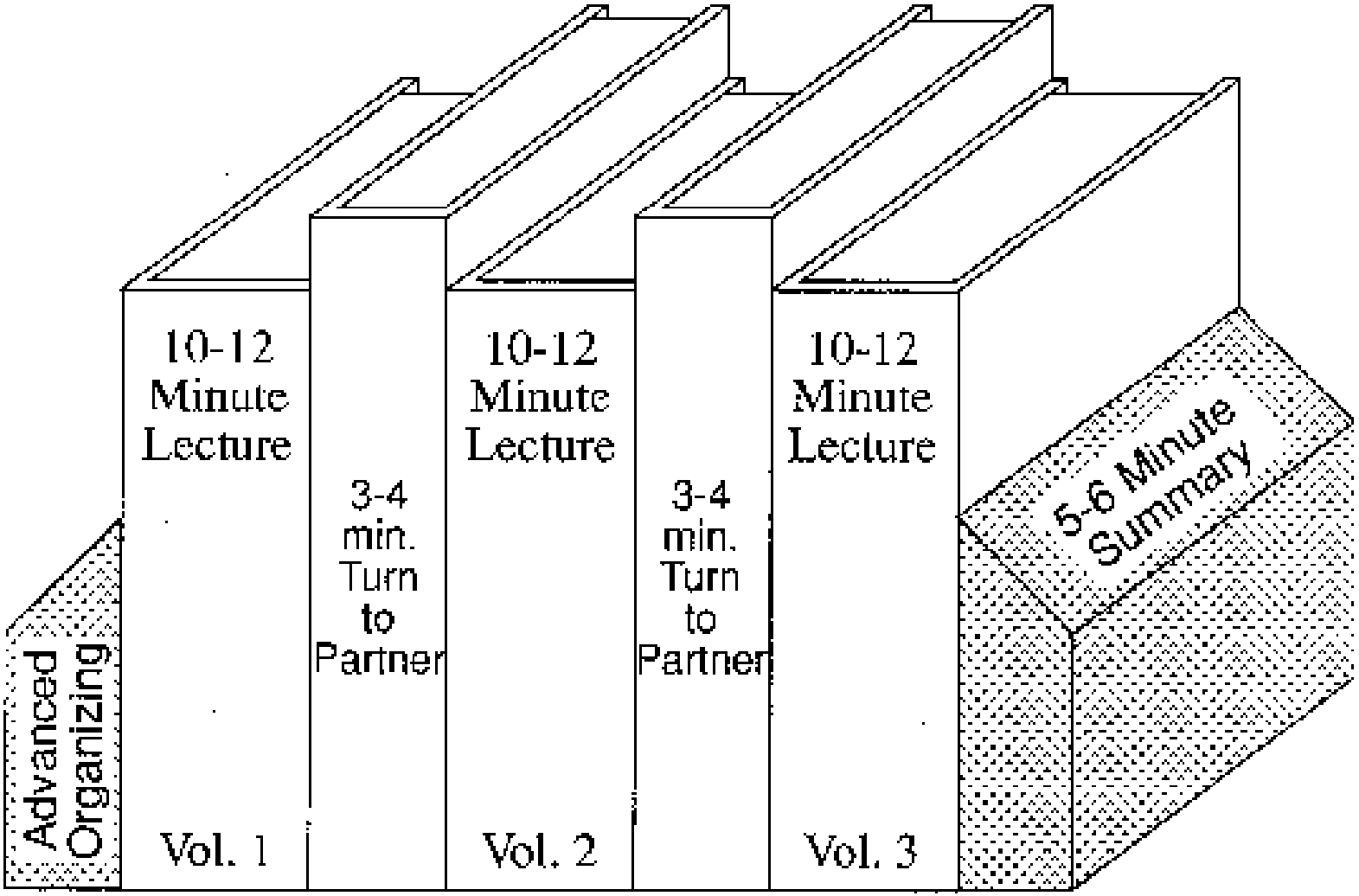
http://www.ce.umn.edu/~smith/docs/Smith-CL%20Handout%2008.pdf

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.

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.

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 . . .

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

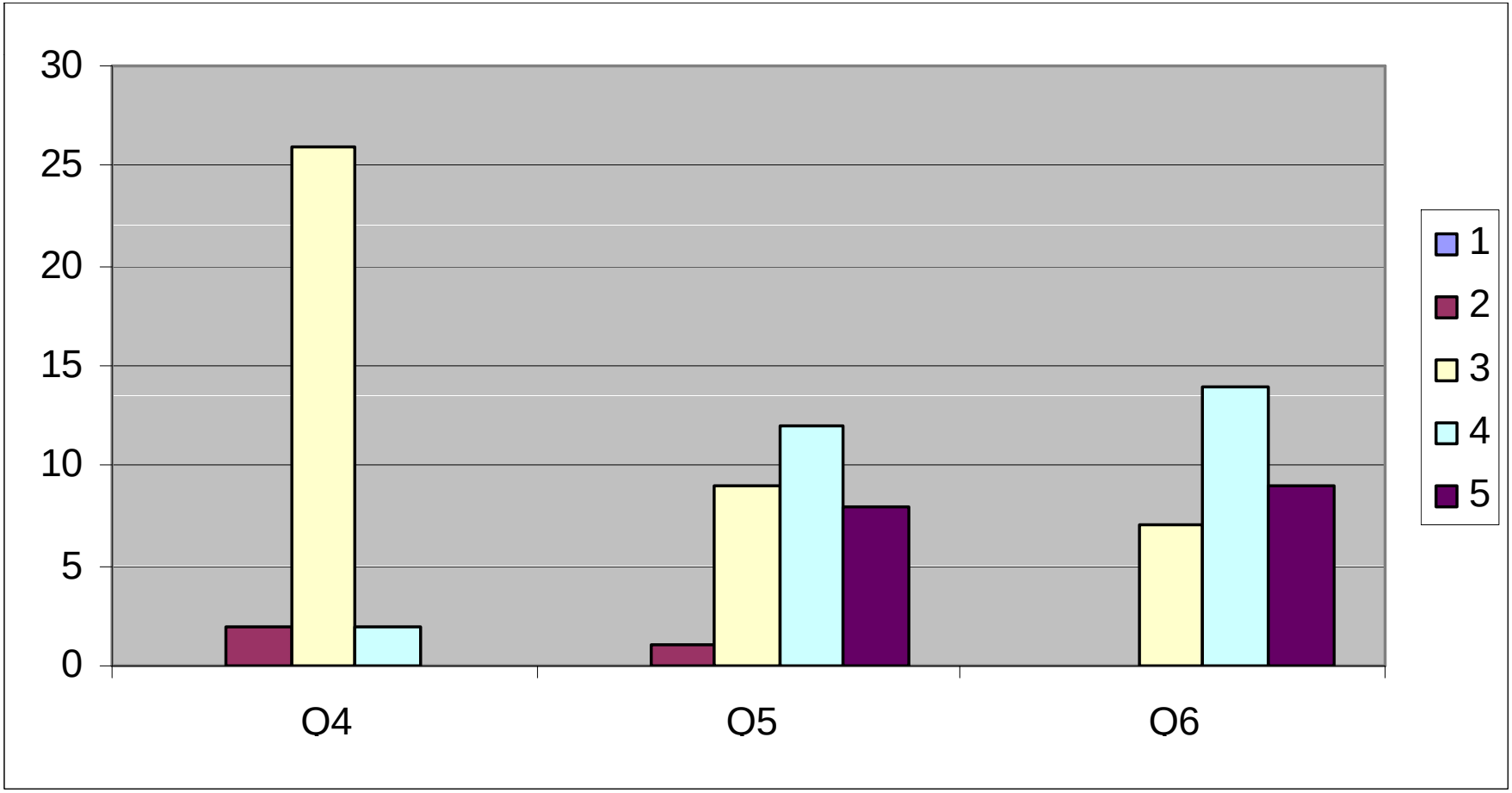
Session Summary
(Minute Paper)

Reflect on the session:

1. Most interesting, valuable, useful thing you learned.
2. Things that helped you learn.
3. Question, comments, suggestions.

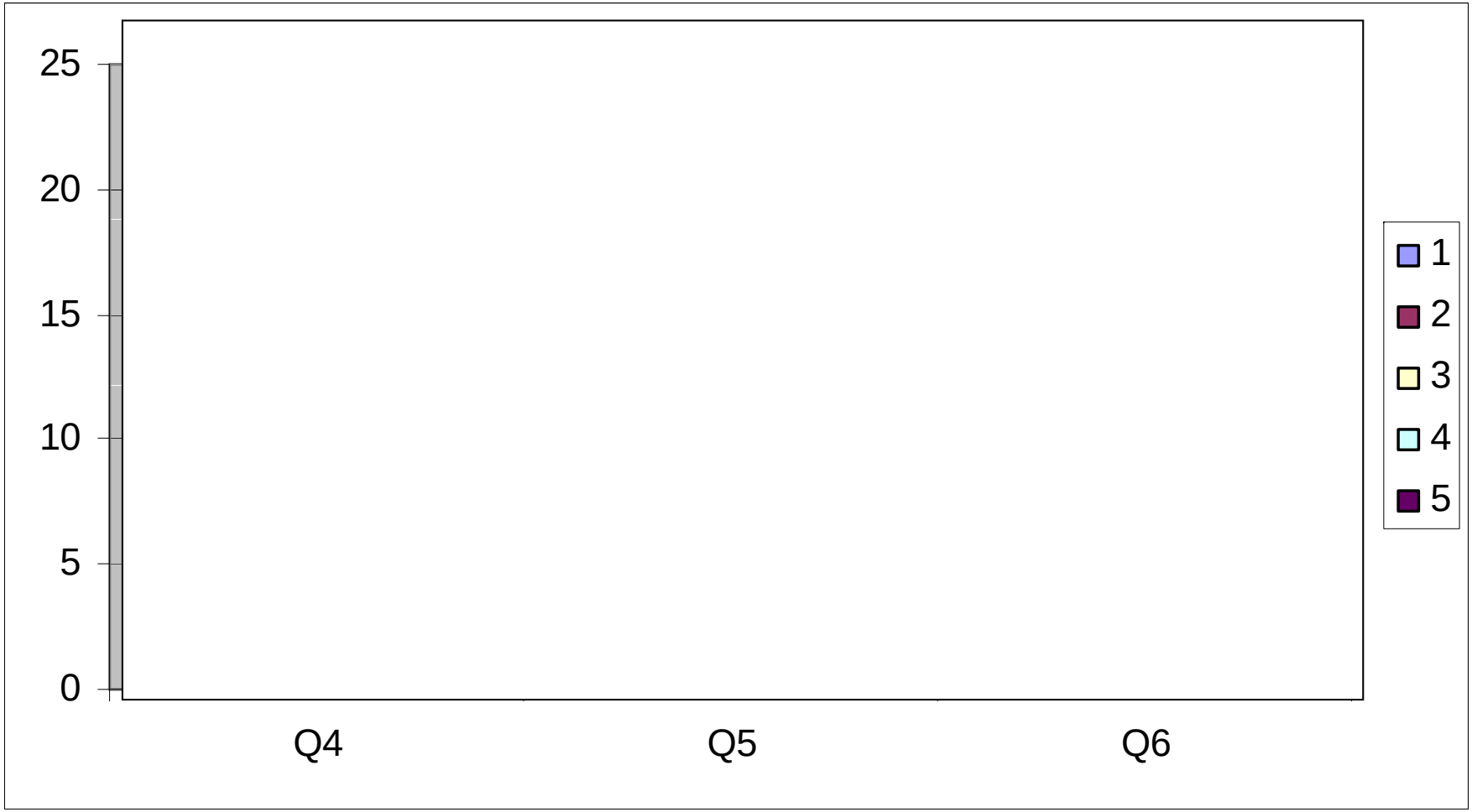
4. Pace: Too slow 1 . . . . 5 Too fast
5. Relevance: Little 1 . . . 5 Lots
6. Instructional Format: Ugh 1 . . . 5 Ah

MOT 8221 – Spring 2010 – Session 1 (1/29/10)



Q4 – Pace: Too slow 1 . . . . 5 Too fast (3.0)
Q5 – Relevance: Little 1 . . . 5 Lots (3.9)
Q6 – Format: Ugh 1 . . . 5 Ah (4.1)

ACSLV CL Workshop November 6, 2010 – Session 1



Q4 – Pace: Too slow 1 . . . . 5 Too fast (3.3)
Q5 – Relevance: Little 1 . . . 5 Lots (4.2)
Q6 – Format: Ugh 1 . . . 5 Ah (4.4)

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

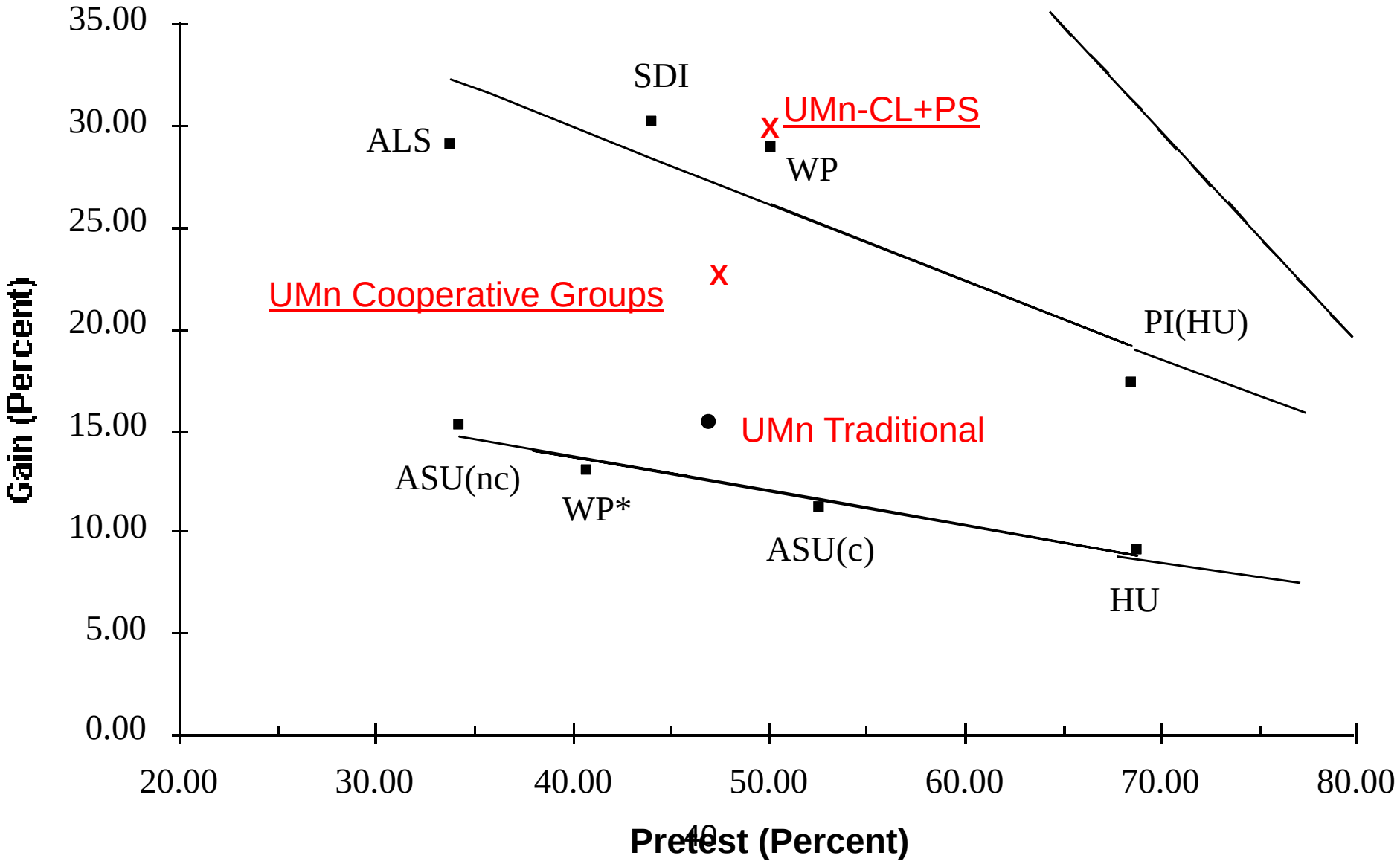
Video: How Change Happens: Breaking the "Teach as You Were Taught"

Cycle – Films for the Humanities & Sciences – www.films.com

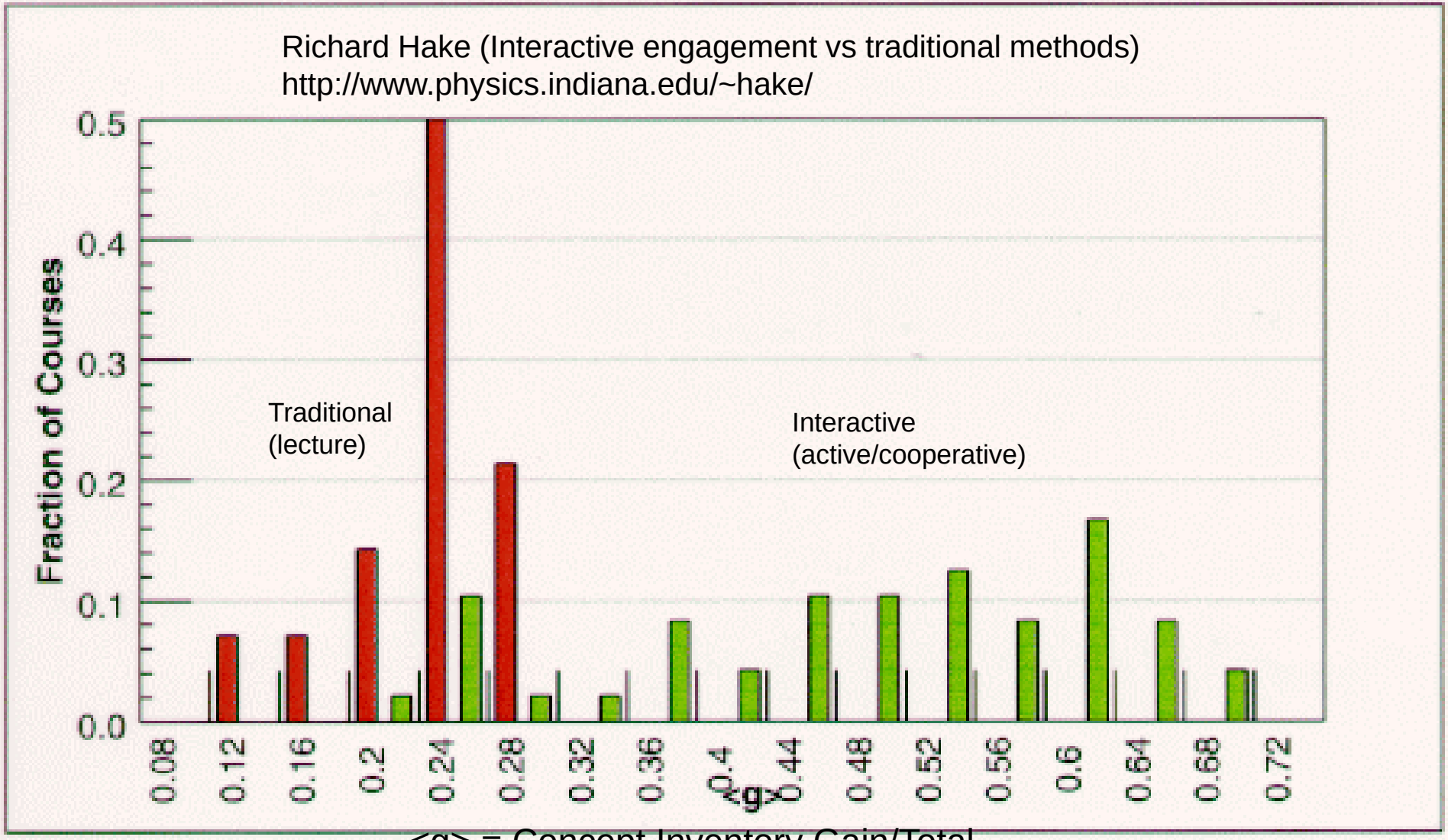
Harvard – Derek Bok Center

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

The “Hake” Plot of FCI



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



<g> = Concept Inventory Gain/Total

Fig. 2. Histogram of the average normalized gain <g>: 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 <g> values shown.

III. CONCEPTUAL TEST RESULTS

A. Gain vs Pretest Graph - All Data

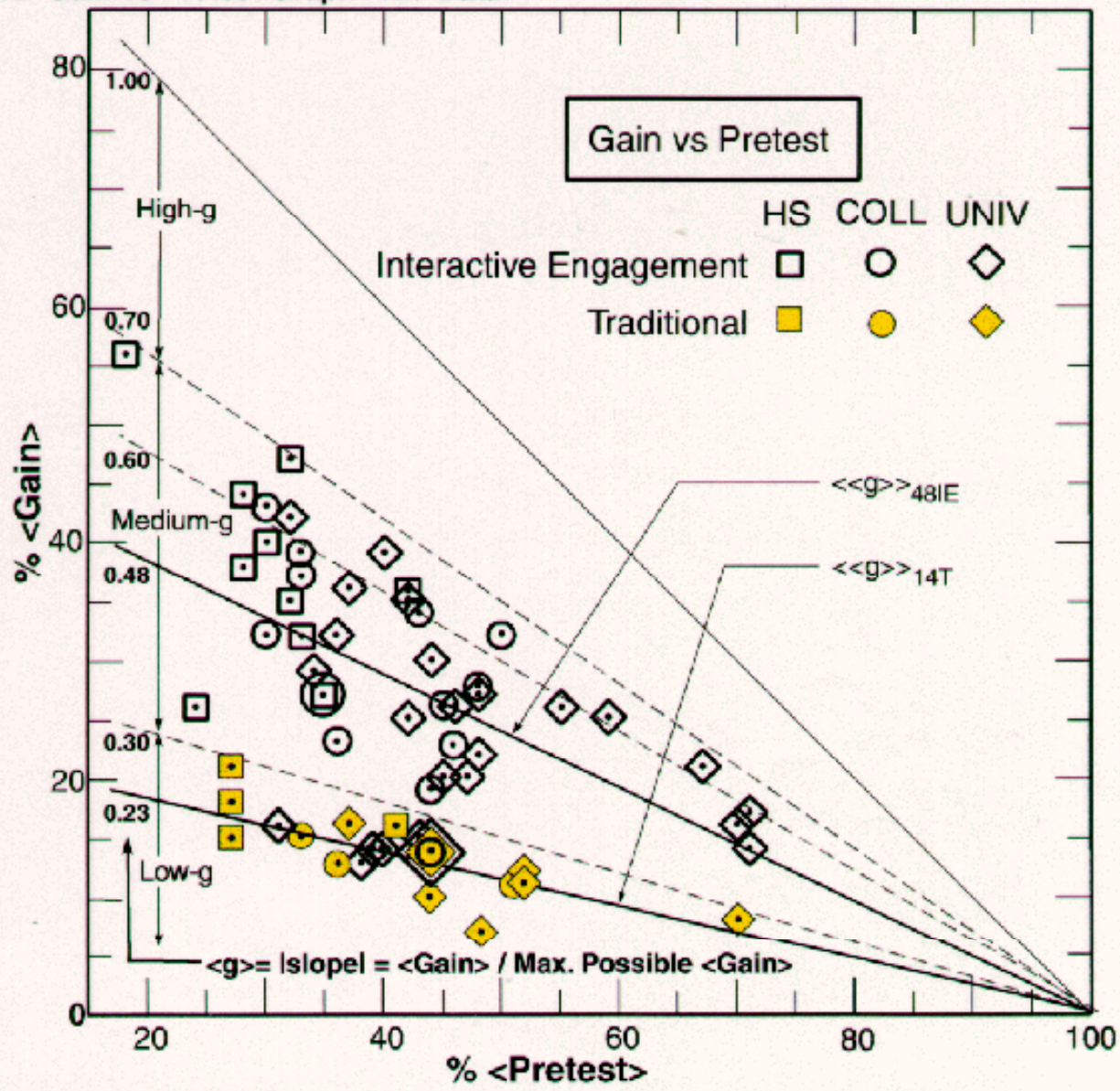


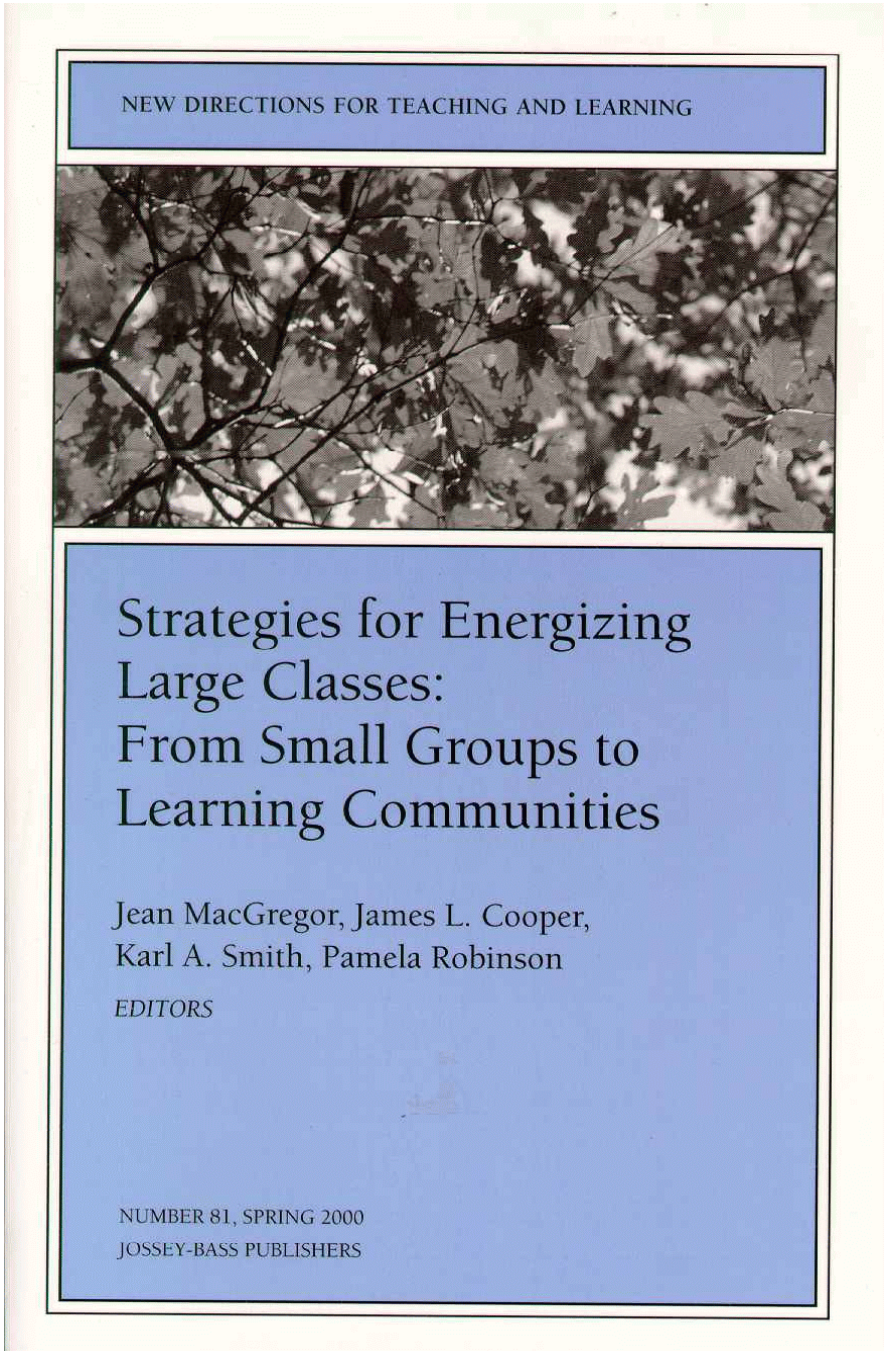
Fig. 1. %<Gain> vs %<Pretest> score on the conceptual Mechanics Diagnostic (MD) or Force Concept Inventory (FCI) tests for 62 courses enrolling a total N = 6542 students: 14 traditional (T) courses (N = 2084) which made little or no use of interactive engagement (IE) methods, and 48 IE courses (N = 4458) 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



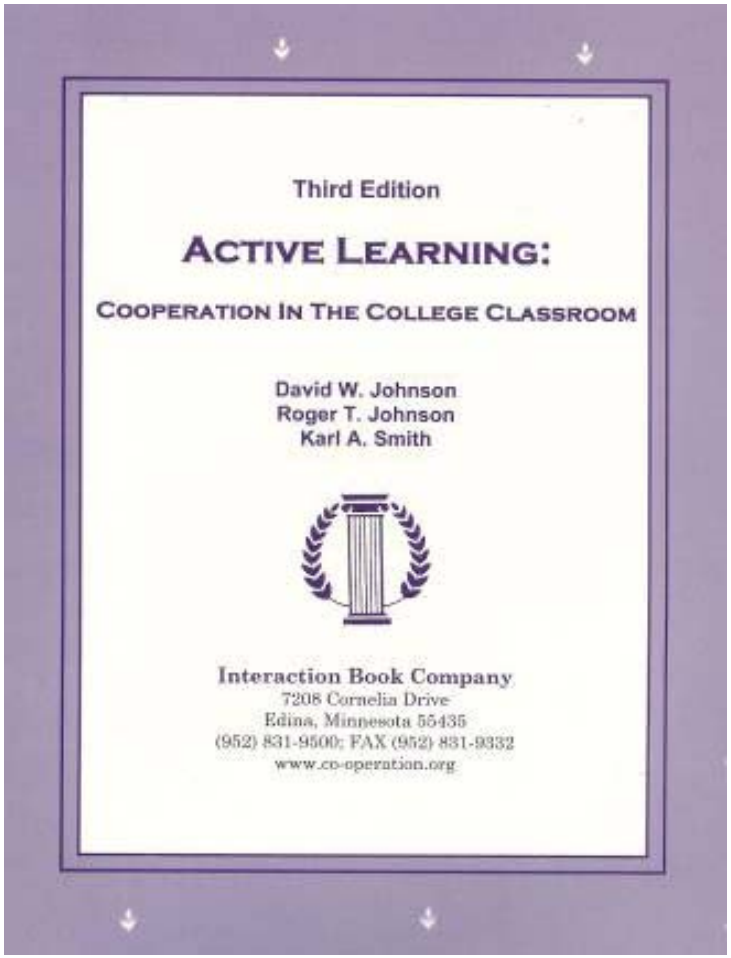
Strategies for Energizing Large Classes: From Small Groups to Learning Communities:

Jean MacGregor,
James Cooper,
Karl Smith,
Pamela Robinson

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

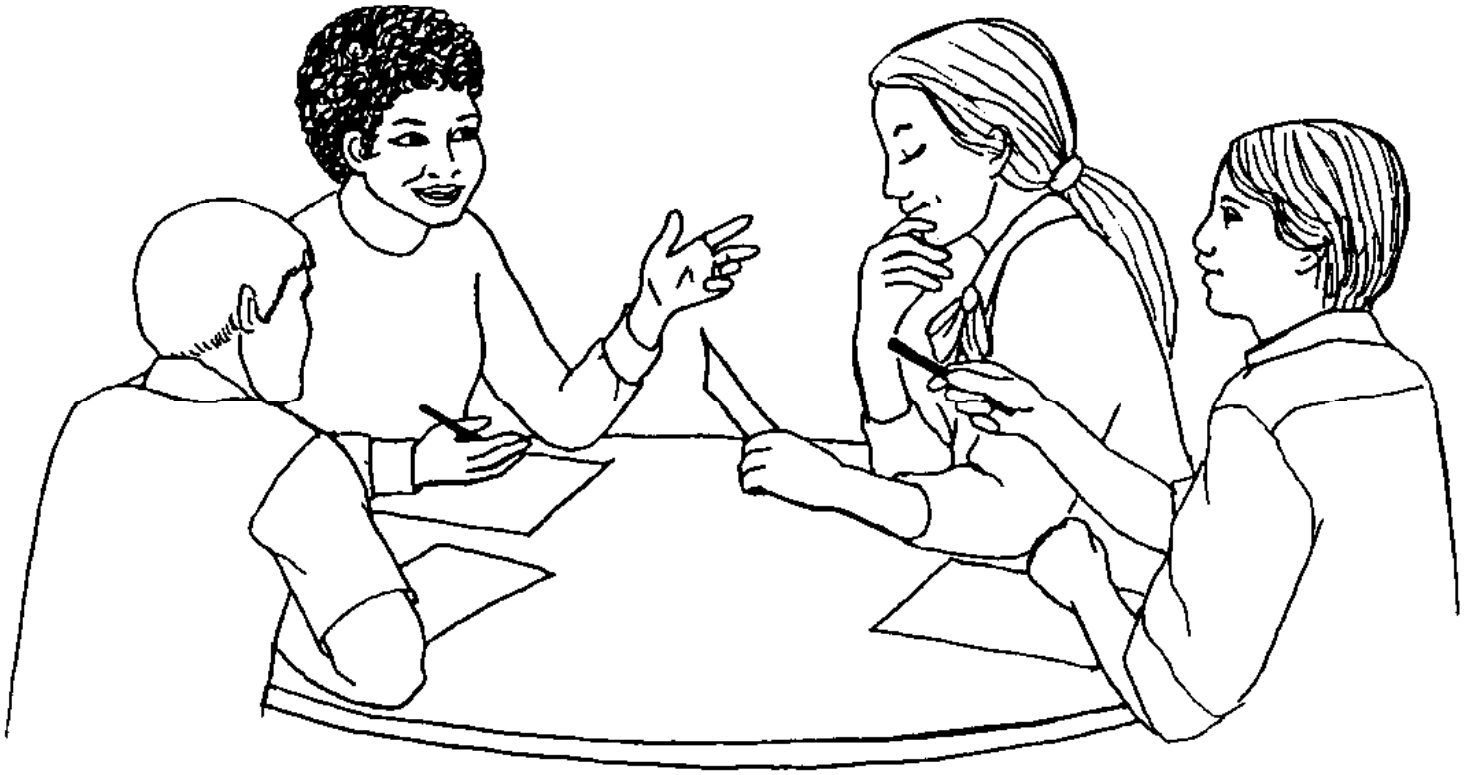
Active Learning: Cooperation in the College Classroom

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



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

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

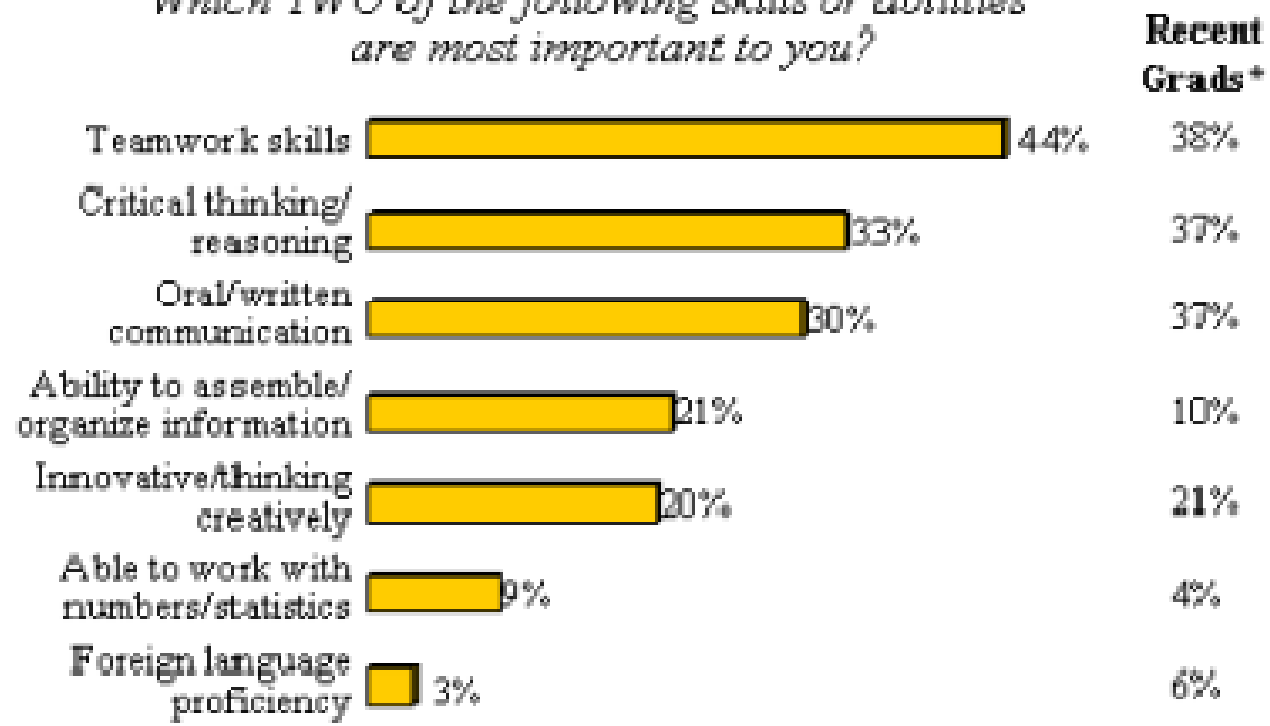
By Peter D. Hart Research Associates, Inc.

December 28, 2006

Peter D. Hart Research Associates, Inc.
1724 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

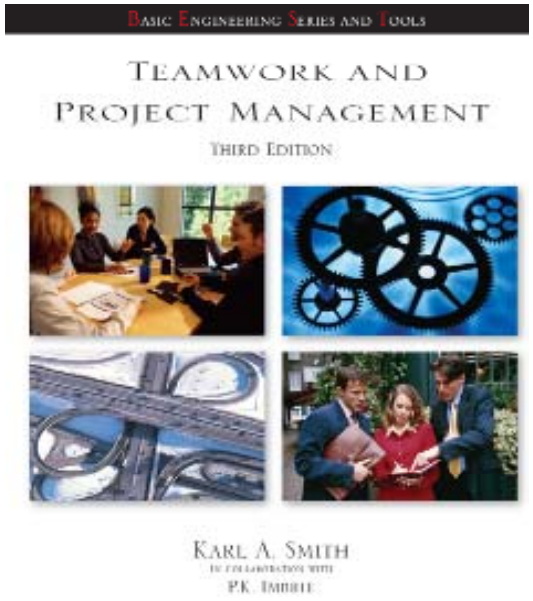
Top Three Main Engineering Work Activities

Engineering Total

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

Civil/Architectural

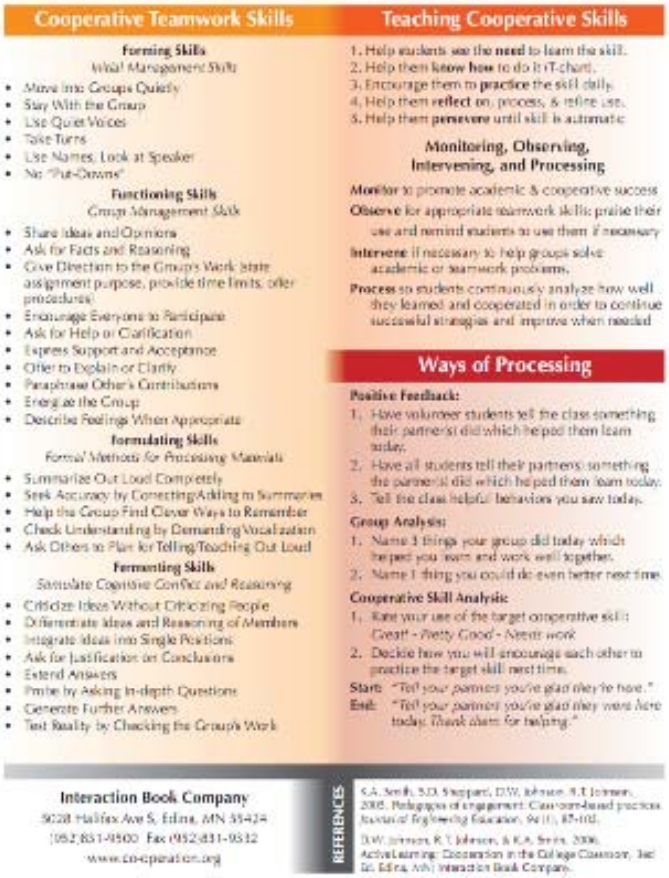
- Management – 45%
- Design – 39%
- Computer applications – 20%



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

Teamwork Skills

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



Cooperative Teamwork Skills

Forming Skills
Initial Management Skills

- Move into Groups Quietly
- Stay With the Group
- Use Quiet Voices
- Take Turns
- Use Names; Look at Speaker
- No "Put-Downs"

Functioning Skills
Group Management Skills

- Share Ideas and Opinions
- Ask for Facts and Reasoning
- Give Direction to the Group's Work (state assignment purpose, provide time limits, offer procedures)
- Encourage Everyone to Participate
- Ask for Help or Clarification
- Express Support and Acceptance
- Offer to Explain or Clarify
- Paraphrase Other's Contributions
- Energize the Group
- Describe Feelings When Appropriate

Formulating Skills
Formal Methods for Processing Materials

- Summarize Out Loud Completely
- Seek Accuracy by Correcting/Adding to Summaries
- Help the Group Find Clever Ways to Remember
- Check Understanding by Demanding Vocalization
- Ask Others to Plan for Telling/Teaching Out Loud

Fermenting Skills
Stimulate Cognitive Conflict and Reasoning

- Criticize Ideas Without Criticizing People
- Differentiate Ideas and Reasoning of Members
- Integrate Ideas into Single Positions
- Ask for Justification (or Conclusions)
- Extend Answers
- Probe by Asking In-depth Questions
- Generate Further Answers
- Test Reality by Checking the Group's Work

Teaching Cooperative Skills

1. Help students **see the need** to learn the skill.
2. Help them **know how** to do it (T-chart).
3. Encourage them to **practice** the skill daily.
4. Help them **reflect** on, process, & refine use.
5. Help them **persevere** until skill is automatic.

Monitoring, Observing, Intervening, and Processing

Monitor to promote academic & cooperative success

Observe for appropriate teamwork skills; praise their use and remind students to use them if necessary

Intervene if necessary to help groups solve academic or teamwork problems.

Process so students continuously analyze how well they learned and cooperated in order to continue successful strategies and improve when needed

Ways of Processing

Positive Feedback:

1. Have volunteer students tell the class something their partner(s) did which helped them learn today.
2. Have all students tell their partner(s) something the partner(s) did which helped them learn today.
3. Tell the class helpful behaviors you saw today.

Group Analysis:

1. Name 3 things your group did today which helped you learn and work well together.
2. Name 1 thing you could do even better next time.

Cooperative Skill Analysis:

1. Rate your use of the target cooperative skill: *Great! - Pretty Good - Needs work*
2. Decide how you will encourage each other to practice the target skill next time.

Start: *"Tell your partners you're glad they're here."*
End: *"Tell your partners you're glad they were here today. Thank them for helping."*

Interaction Book Company
5028 Halifax Ave S, Edina, MN 55424
(952) 831-9500 Fax (952) 831-9332
www.co-operation.org

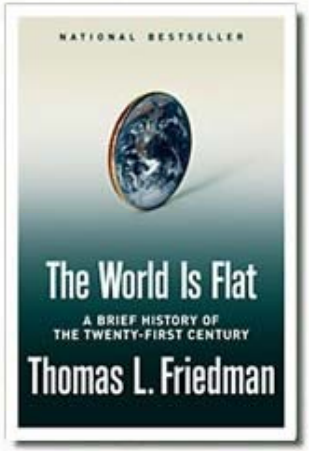
REFERENCES
K.A. Smith, S.D. Sheppard, D.W. Johnson, R.T. Johnson, 2005. Pedagogies of engagement: Classroom-based practices. *Journal of Engineering Education*, 94 (1), 87-101.
D.W. Johnson, R.T. Johnson, & K.A. Smith, 2006. *Active Learning: Cooperation in the College Classroom*, 3rd Ed. Edina, MN: Interaction Book Company.

Ideo's five-point model for strategizing by design:

Hit the Streets
Recruit T-Shaped People
Build to Think
The Prototype Tells a Story
Design Is Never Done

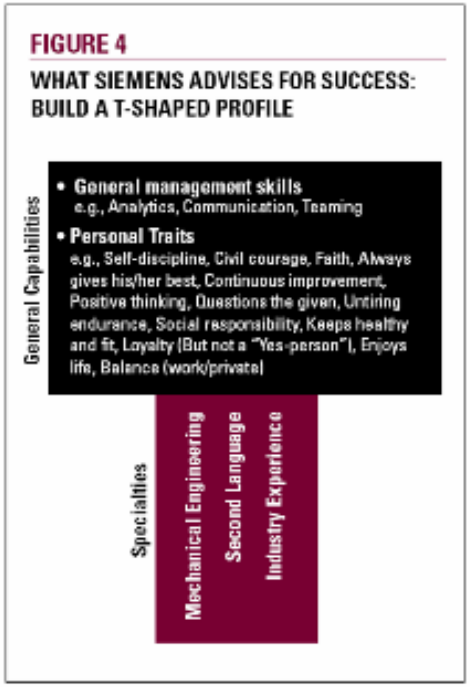
Design Thinking

Discipline Thinking



Tom Friedman
Horizontalize Ourselves

CQ+PQ>IQ



AAC&U *College Learning For the New Global Century*

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

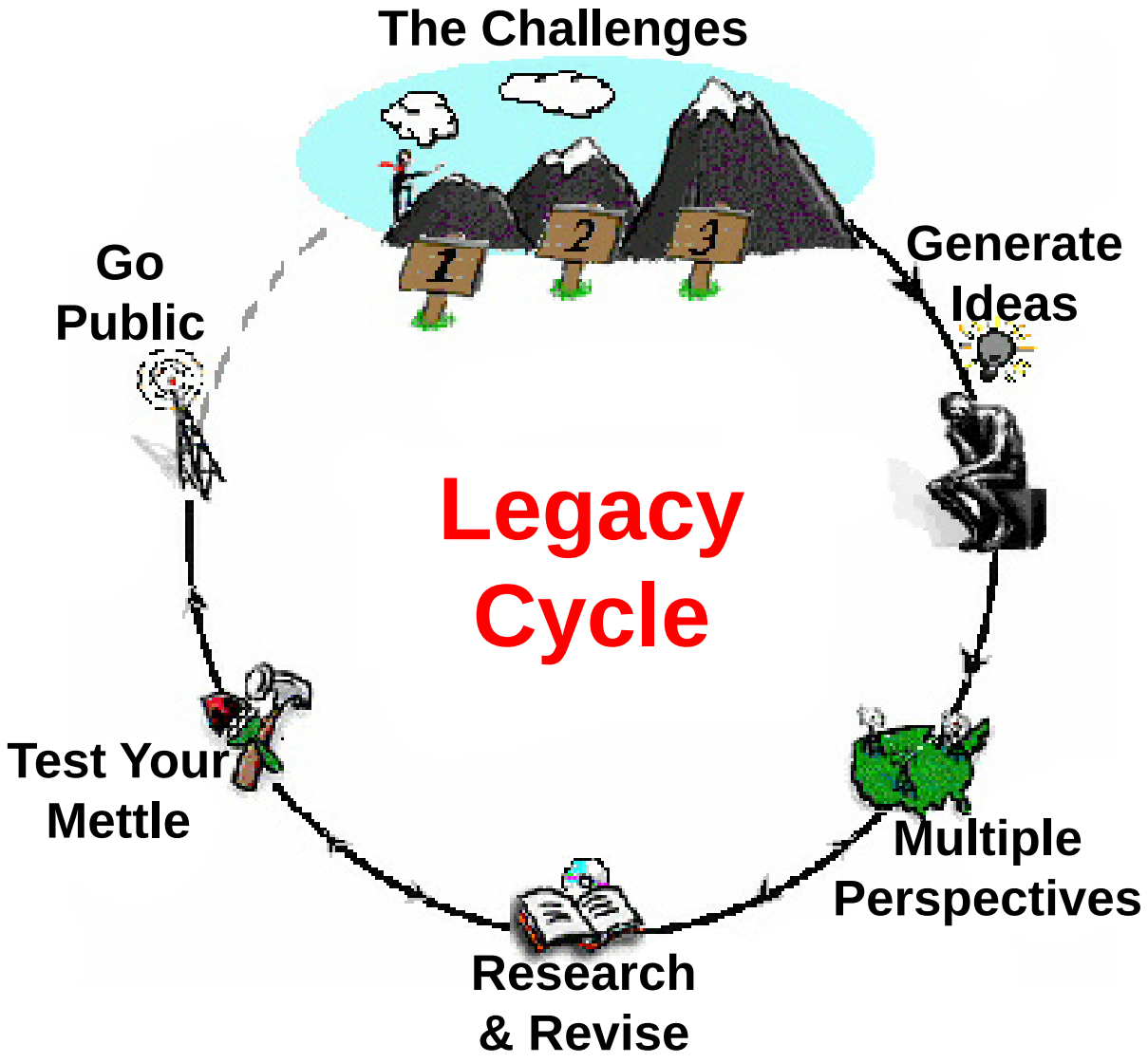
1. Jigsaw – Learning new conceptual/procedural material
2. Peer Composition or Editing
3. Reading Comprehension/Interpretation
4. **Problem Solving, Project, or Presentation**
5. Review/Correct Homework
6. Constructive Academic Controversy
7. Group Tests

Challenge-Based Learning

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

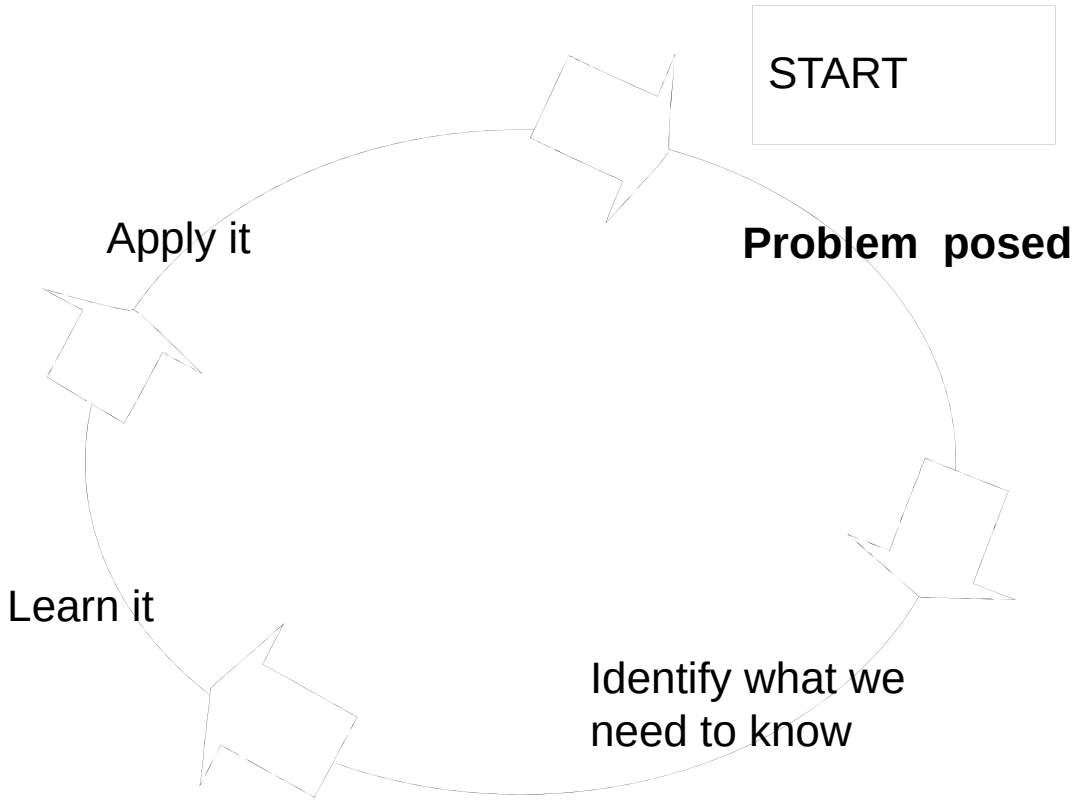
John Bransford, Nancy Vye and Helen Bateman. Creating High-Quality Learning Environments: Guidelines from Research on How People Learn

Challenge-Based Instruction with the Legacy Cycle



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

Problem-Based Learning



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

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.

PROBLEM-BASED LEARNING

UD PBL articles and books

UD PBL in the news

Sample PBL problems

UD PBL courses and syllabi

PBL Clearinghouse

PBL Conferences and Other PBL sites

Institute for Transforming Undergraduate Education

Other related UD sites

"How can I get my students to think?" is a question asked by many faculty, regardless of their disciplines. Problem-based learning (PBL) is an instructional method that challenges students to "learn to learn," working cooperatively in groups to seek solutions to real world problems. These problems are used to engage students' curiosity and initiate learning the subject matter. PBL prepares students to think critically and analytically, and to find and use appropriate learning resources. -- *Barbara Duch*

PBL2002: A Pathway to Better Learning

Recipient of 1999 Hesburgh Certificate of Excellence

UD PBL

Please direct comments, suggestions, or requests to ud-pbl@udel.edu.
"http://www.udel.edu/pbl/"
Last updated March 13, 2004.

http://www.udel.edu/pbl/

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

Design and Implementation of Cooperative Learning – 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