Collaboration in Learning and Design

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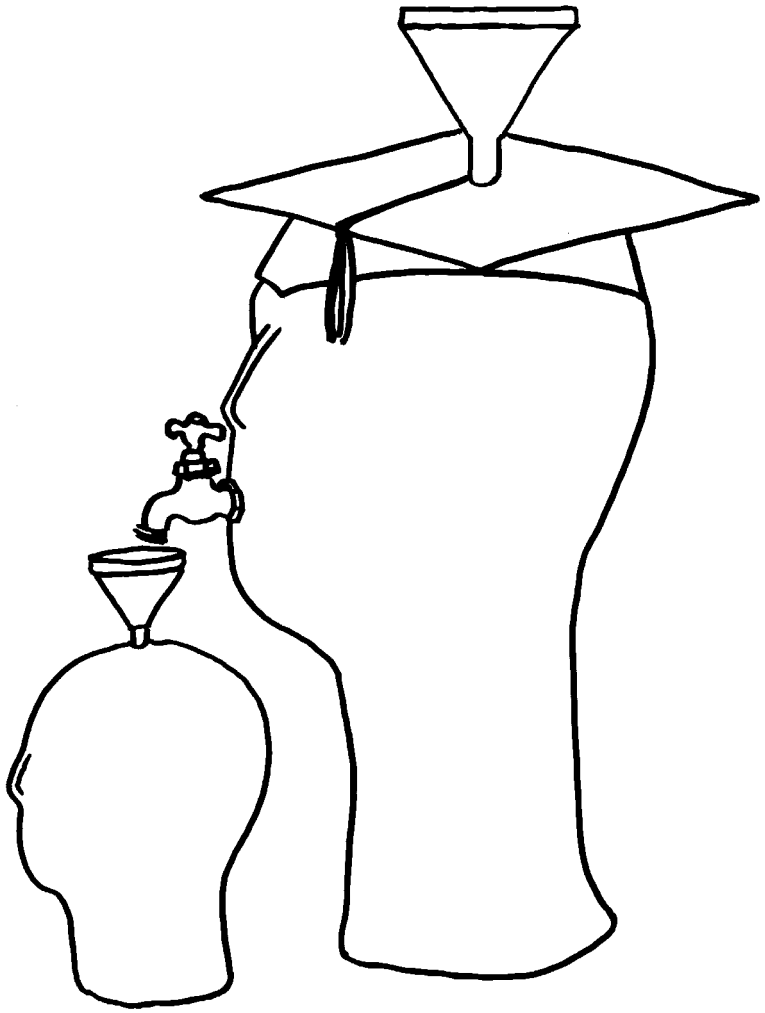
PBL 2002
A Pathway to Better Learning

June, 2002



Lila M. Smith

Pedago-pathologies – Lee Shulman

Amnesia

Fantasia

Inertia

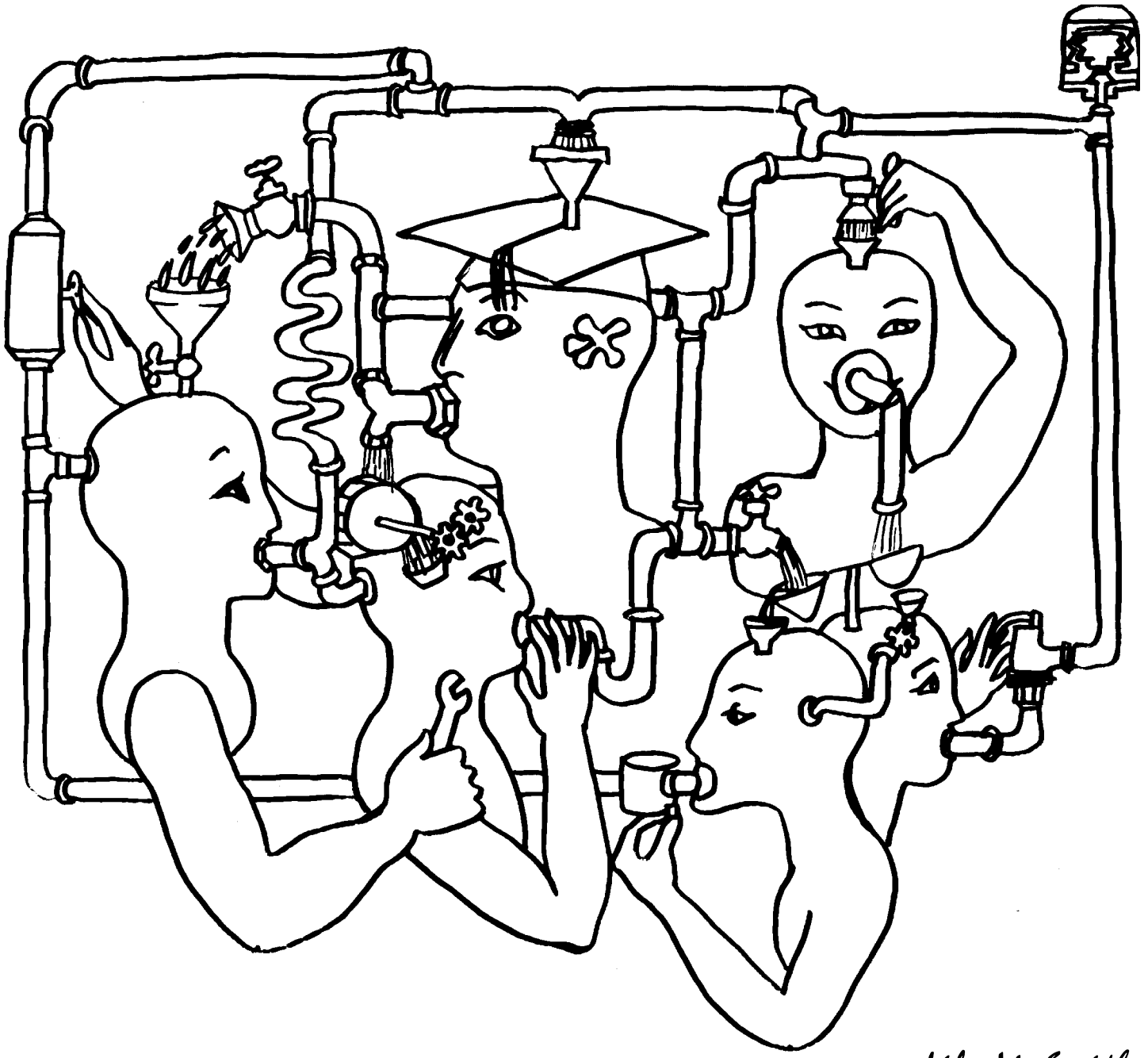
Shulman, Lee S. 1999. Taking learning seriously. *Change, 31* (4), 11-17.

What do we do about these pathologies? – Lee Shulman

Activity
Reflection
Collaboration
Passion

Combined with *generative content* and the creation of powerful learning *communities*

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


Lila M. Smith

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

Task Interdependence
1. Factory-line
2. Chain Reaction

Identity Interdependence
Mutual identity (name, motto, etc.)

Resource Interdependence
1. Limit resources (one set of materials)
2. Jigsaw materials
3. Separate Contributions

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

Duty (Role) Interdependence
Assign each member a role and rotate them

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
3. Nonacademic rewards (Food, free time, etc.)
4. Single group grade (when fair to all)

Outside Challenge Interdependence
1. Intergroup competition
2. Other class competition

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

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Individual Accountability

Ways to ensure no slackers:

- Keep group size small
- 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 the information"
- 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!

Foundation Coalition - Netscape

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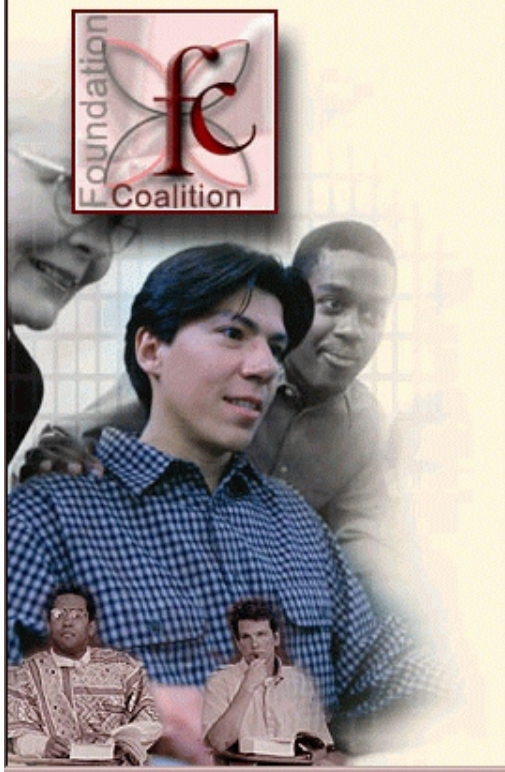
Bookmarks Location: http://clte.asu.edu/active/main.htm What's Related

Active/Cooperative Learning: Best Practices in Engineering Education

A Dissemination Project of the Foundation Coalition

Overview of A/CL | Preparing Students | Planning A/CL Lessons | Implementing A/CL | Lessons & Activites | Participant Profiles

Active/Cooperative Learning : Best Practices in Engineering Education



A Dissemination Project of the Foundation Coalition

http://www.foundationcoalition.org

Welcome from the Principal Investigator

Donovan Evans, Director
Center for Research on Education in Science, Math Engineering, and Technology
Arizona State University

Overview from the Project Director

Susan Ledlow, Instructional Professional
Center for Learning and Teaching Excellence
Arizona State University

Project Staff

Copyright Information

Acknowledgements

http://clte.asu.edu/active

Document: Done

HOW TO MODEL IT

PROBLEM SOLVING FOR THE COMPUTER AGE

Anthony M. Starfield ■ Karl A. Smith ■ Andrew L. Bleloch

" 'How to Model It' . . . it is a serious attempt to teach modeling. . . . it's the best I've seen on the subject."
Jerry Pournelle, BYTE Magazine, March 1991 © McGraw-Hill, Inc.

CONTENTS

This active learning book has been used by high school students; in both undergraduate and graduate classes; in engineering, business, science and education as well as in professional development workshops.

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Collaboration in Learning and Design

1. Background (Big Picture) on:
   - Collaboration
   - Design
   - Learning
2. Foundations
3. Contribution of Cooperative Learning
   - Principles
   - Practices
4. Communities of Practice and Social Capital
5. Course/Program Design & Redesign

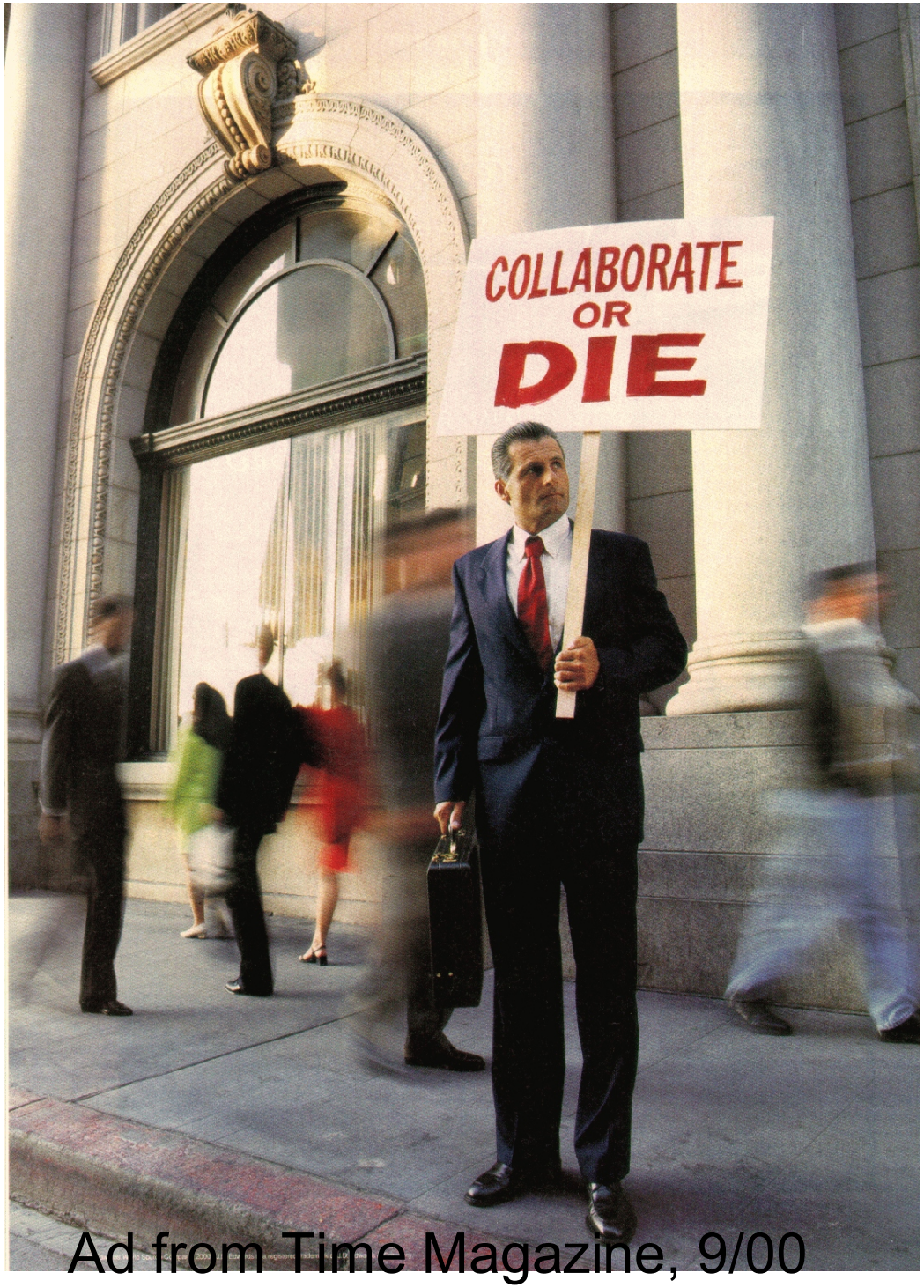
Collaboration

Collaboration is a *purposive* relationship. At the heart of collaboration is a desire or need to

- solve a problem,
- create, or
- discover something

Within a set of constraints, including expertise, time, money, competition, and conventional wisdom (p. 36)

Michael Schrage. 1991. *Shared minds: The new technologies of collaboration.*



Ad from Time Magazine, 9/00

Design

Engineering design is the process of devising a system, component or process to meet a desired need. (Accreditation Board for Engineering and Technology).

Design in a major sense is the essence of engineering; it begins with the identification of a need and ends with a product or system in the hands of a user. It is primarily concerned with synthesis rather than the analysis which is central to engineering science. Design, above all else, distinguishes engineering from science (Hancock, 1986, National Science Foundation Workshop).

A scientist discovers that which exists. An engineer creates that which never was. (Theodore von Kármán, 1881-1963).

Design defines engineering. It's an engineer's job to create new things to improve society. It's the University's obligation to give students fundamental education in design (William Durfee, ME, U of Minnesota, *Minnesota Technolog*, Nov/Dec 1994).

Those who observe the process of engineering design find that it is not a totally formal affair, and that drawings and specifications come into existence as a result of a social process. The various members of a design group can be expected to have divergent views of the most desirable ways to accomplish the design they are working on. As Louis Bucciarelli, (*Designing Engineers*,1994), an engineering professor who has observed engineering designers at work, points out, informal negotiations, discussions, laughter, gossip, and banter among members of a design group often have a leavening effect on its outcome.

Eugene Ferguson (1992)

Design – A social process that identifies a need, defines a problem, and specifies a plan that enables others to manufacture the solutions

Larry Leifer – Stanford (www.cdr.stanford.edu (Accessed 9/6/00)

Engineering design practices:

- negotiating understanding
- conserving ambiguity
- tailoring engineering communications for recipients
- manipulating mundane representations

Scott Minneman - Xerox PARC
Larry Leifer – Stanford

The future of design:
A question of visualization
John Leinhard

Three keys to successful design:

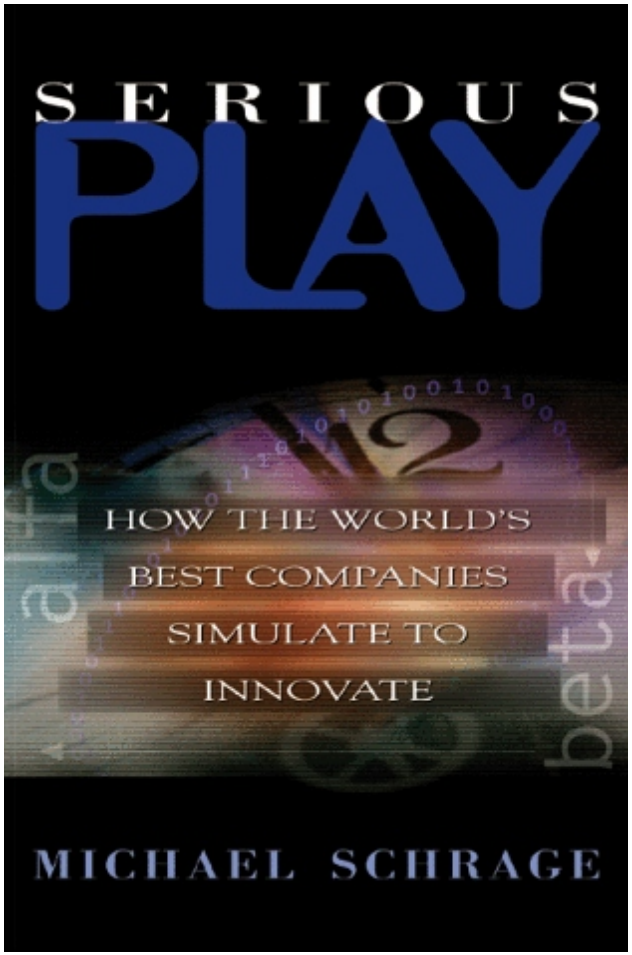
1. Rapid trial and error

2. Powerful cooperation

3. A new way of seeing (Visualization)

John Leinhard, September 20, 1995, Presentation at ASME Design Conference. See Engines of Our Ingenuity web site (www.uh.edu/engines)

Rapid Trial and Error



Prototyping
Innovation
Collaboration

"Prototyping is probably the single most pragmatic behavior the innovative firm can practice"

"Innovation is more social than personal"

Michael Schrage. 2000. *Serious Play: How the World's Best Companies Simulate to Innovate*

Learning

897 – The action of receiving instruction or acquiring knowledge (Oxford English Dictionary)

ca. 1975 – “a relatively permanent change in behavior as a result of practice with feedback” (U of MN College of Education)

ca. 2000 –

1. Learning is a social activity (John Dewey)
2. All learning requires un-learning (John Seely Brown)

Study & Practice

These Chinese characters represent the word "learning." The first character means to study. It is composed of two parts: a symbol that means "to accumulate knowledge," above a symbol for a child in a doorway.

The second character means to practice constantly, and it shows a bird developing the ability to leave the nest. The upper symbol represents flying; the lower symbol, youth. For the oriental mind, learning is ongoing. "Study" and "practice constantly," together, suggest that learning should mean: "mastery of the way of self-improvement." (Peter Senge)

The roots of the English word for learning suggest that it once held a similar meaning. It originated with the Indo-European leis, a noun meaning "track" or "furrow." To "learn" came to mean gaining experience by following a track-- presumably for a lifetime. (Art Kleiner)

Design & Learning

- Engineering design is a social activity
- Designers require ambiguity
- All design is re-design

- Education is a social activity
- Learning requires ambiguity
- All education is re-education

Foundations

1. Learning is a social activity (John Dewey)
2. Innovative learning requires ambiguity (Stuart Pugh)
3. All learning requires un-learning (John Seely Brown)

Foundations - John Dewey

John Dewey's ideal school

- a "thinking" curriculum aimed at deep understanding
- **cooperative learning within communities of learners**
- interdisciplinary and multidisciplinary curricula
- projects, portfolios, and other "alternative assessments" that challenged students to integrate ideas and demonstrate their capabilities.

Dewey, John. 1915. The school and society, 2nd ed. Chicago: University of Chicago Press.

We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great difference.

John Dewey, 1906

Cooperative Learning

Cooperative Learning

Kurt Lewin - Social Interdependence Theory

1. The essence of a group is the interdependence among members (created by common goals) which results in the group being a "dynamic whole" so that a change in the state of any member of subgroup changes the state of any other member or subgroup

2. An intrinsic state of tension within group members motivates movement toward the accomplishment of the desired common goals.

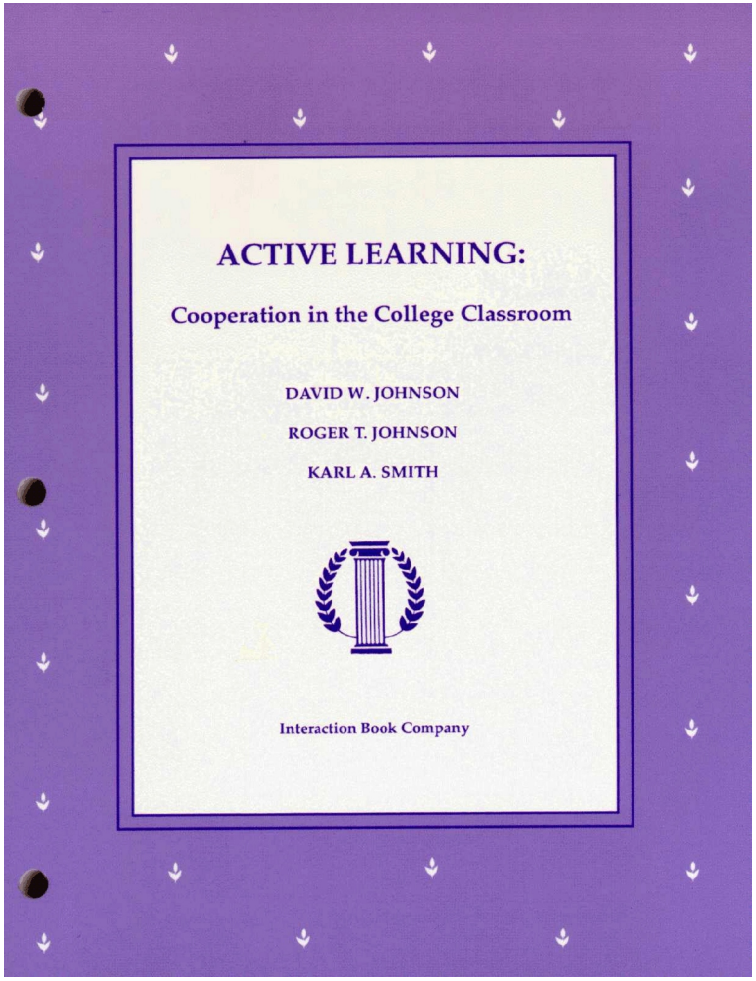
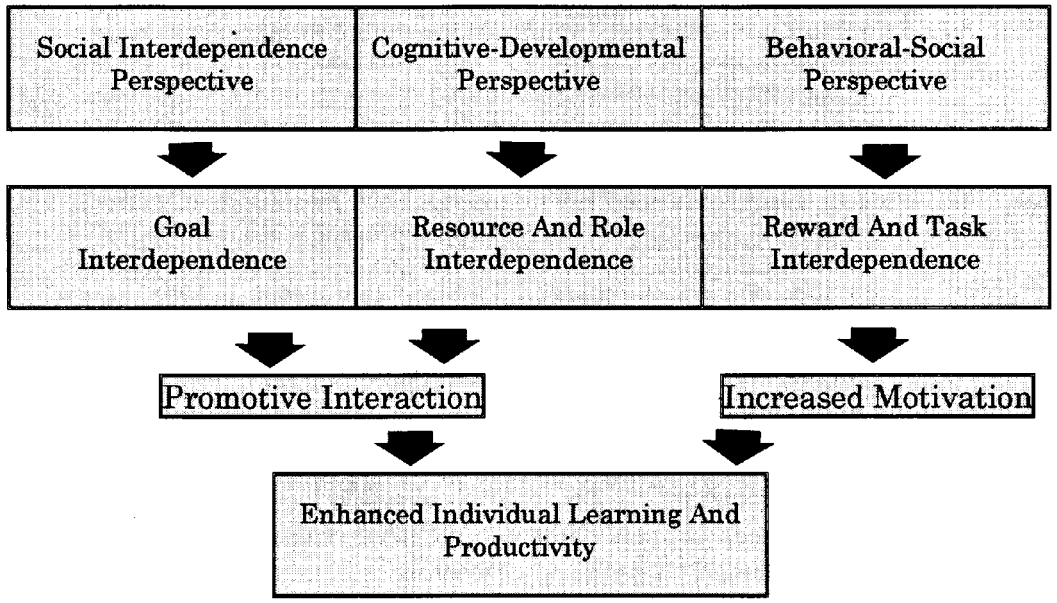


Figure A.1 A General Theoretical Framework



Creative Performance From Students (& Faculty) Requires Maintaining a Creative Tension Between

Challenge and Security

Pelz, Donald, and Andrews, Frank. 1966. Scientists in Organizations: Productive Climates for Research and Development. Ann Arbor: Institute for Social Research, University of Michigan.

Pelz, Donald. 1976. Environments for creative performance within universities. In Samuel Messick (Ed.), *Individuality in learning*, pp. 229-247. San Francisco: Jossey-Bass

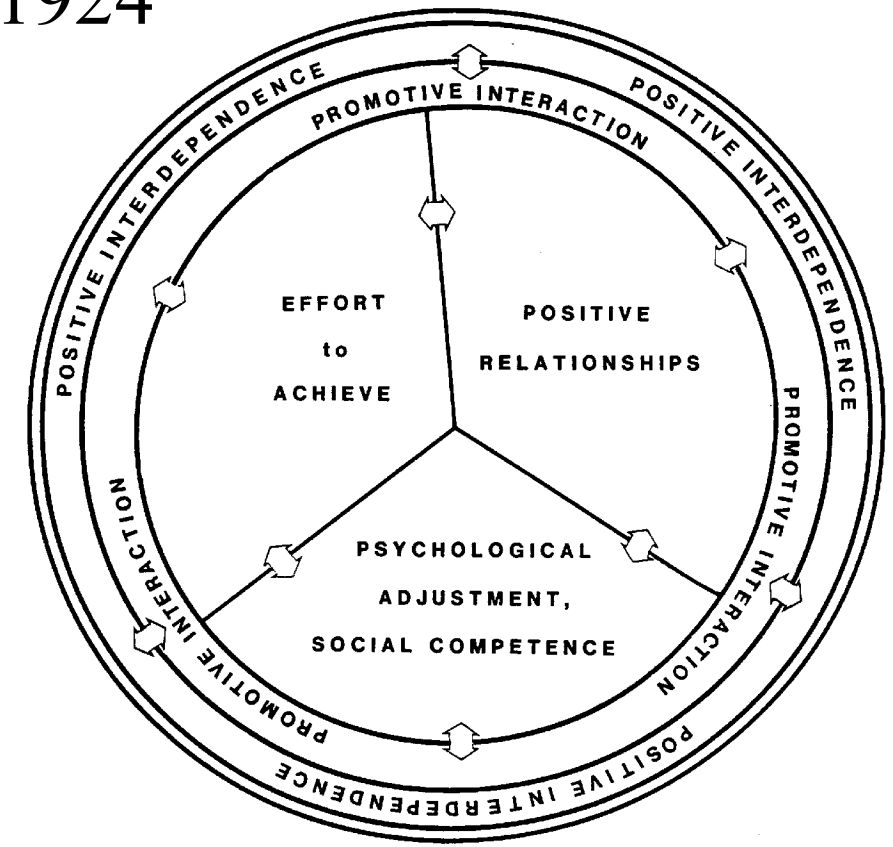
Cooperative Learning Research Support

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

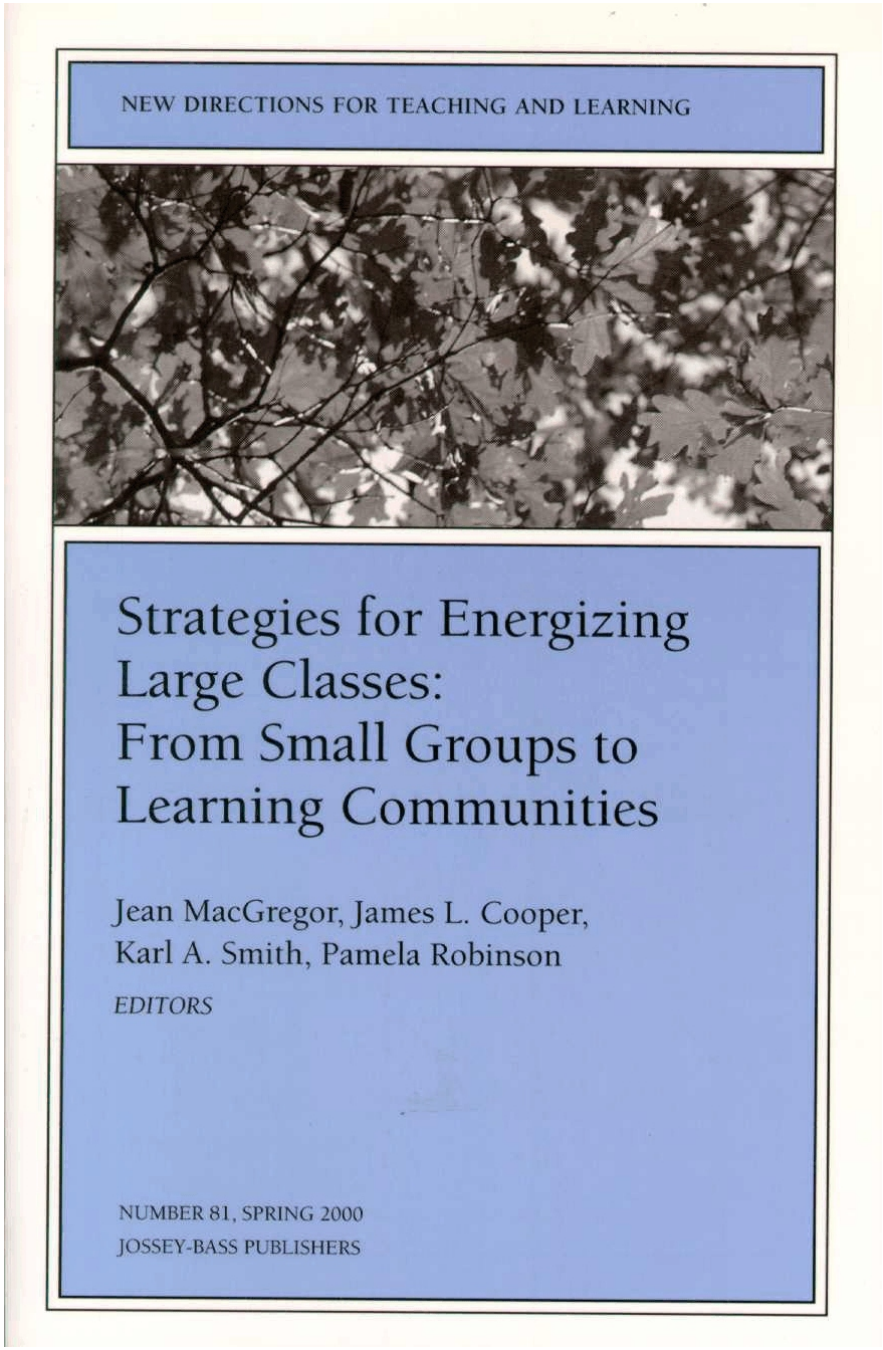


Small-Group Learning: Meta-analysis

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

"The greatest single challenge to SMET pedagogical reform remains the problem of whether and how large classes can be infused with more active and interactive learning methods." (pg. 87)

Seymour, E. 2001. Tracking the processes of change in US undergraduate education in science, math, engineering and technology. *Science Education, 96*, 79-105.

- Learning – In theory and in practice
- Re-education

Learning a practice involves becoming a member of a 'community of practice' and thereby understanding its work and its talk from the inside (p. 126)

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Change

THE MAGAZINE OF HIGHER LEARNING MARCH/APRIL 2000

Growing Up Digital

The Web and a New Learning Ecology

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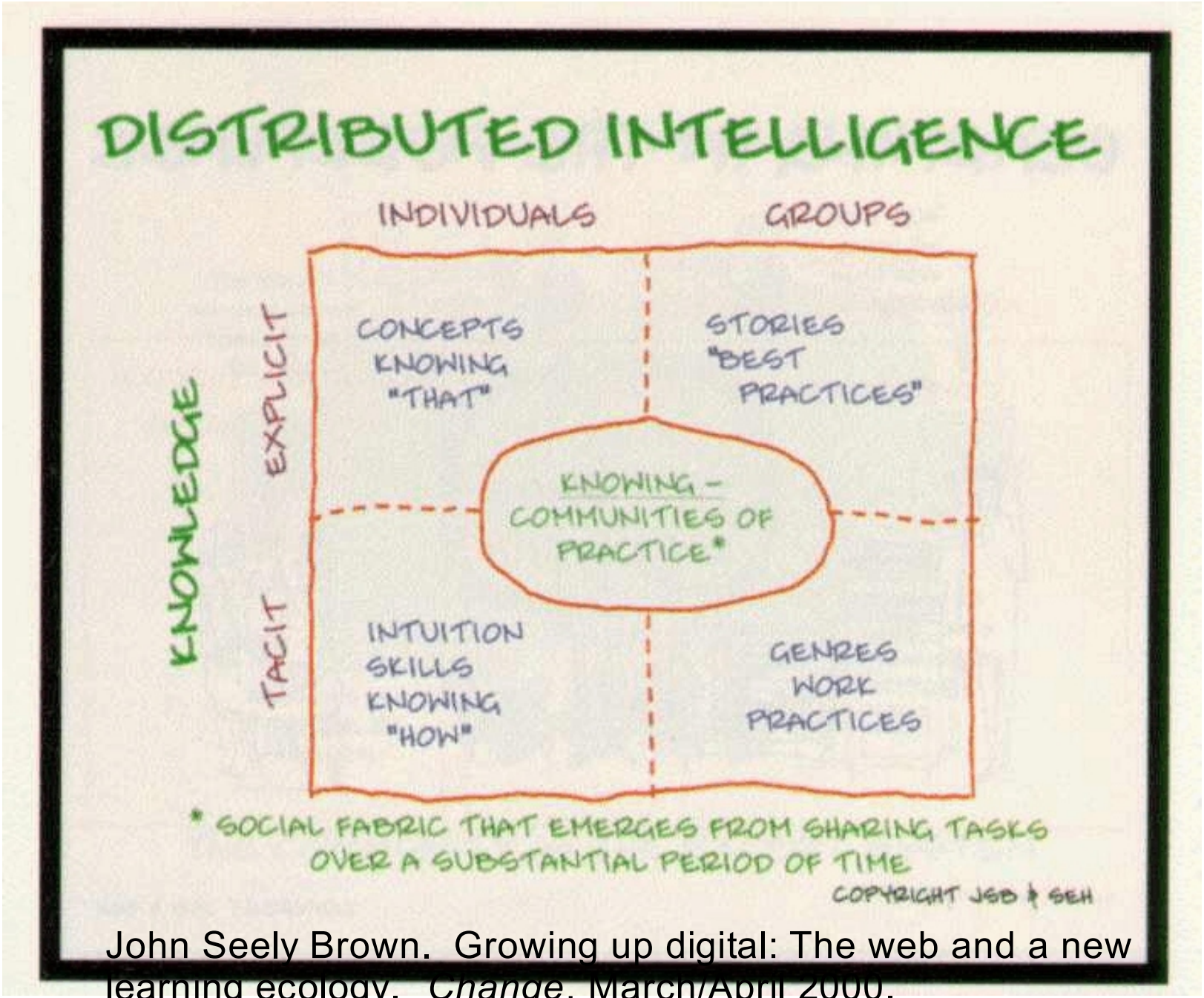


John Seely Brown. Growing up digital: The web and a new learning ecology. *Change*, March/April 2000.

“Insider Knowledge” and Communities of Practice

Where do students gain the “insider knowledge” about surviving (or thriving) in a university, i.e., where do they learn how to act, talk, and think like an successful student?

Where do engineering students gain the “insider knowledge” of engineering, i.e., where do they learn how to act, talk, and think like an engineer?

According to Seely Brown & Duguid (1991), “Learning that is informal, social, and focused on meaningful problems helps create ‘insider knowledge’.”

Gaining insider knowledge is a major part of becoming a member of a community of practice.

Situated Learning and Communities of Practice

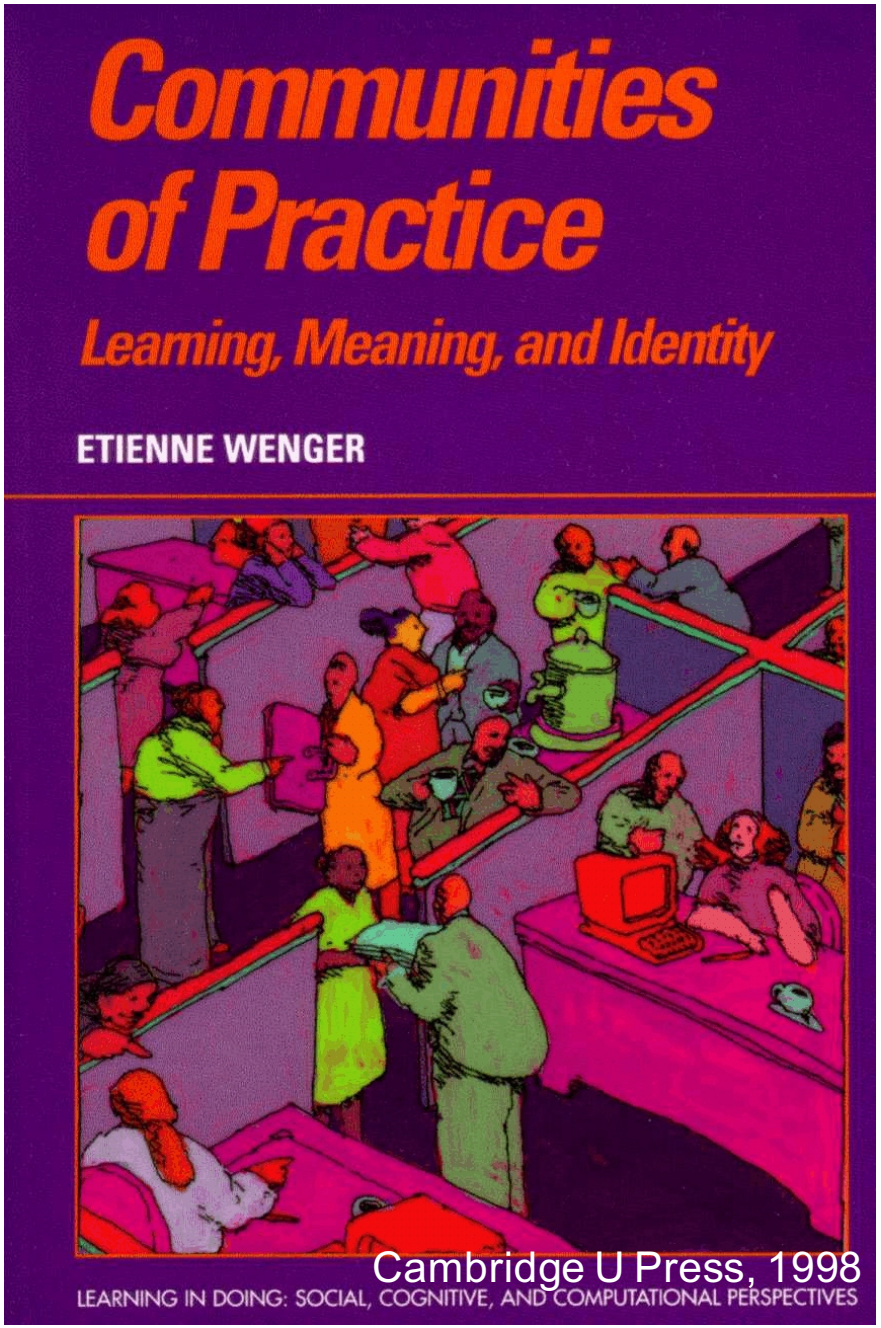
Depends on two claims:

1. It makes no sense to talk of knowledge that is decontextualized, abstract or general.
2. New knowledge and learning are properly conceived as being located in communities of practice.

Pointers for practice:

- Learning is in the relationships among people.
- Educators' role is to help people become participants in communities of practice.
- Learning is a part of everyday life, that is, there is a connection between knowledge and activity.

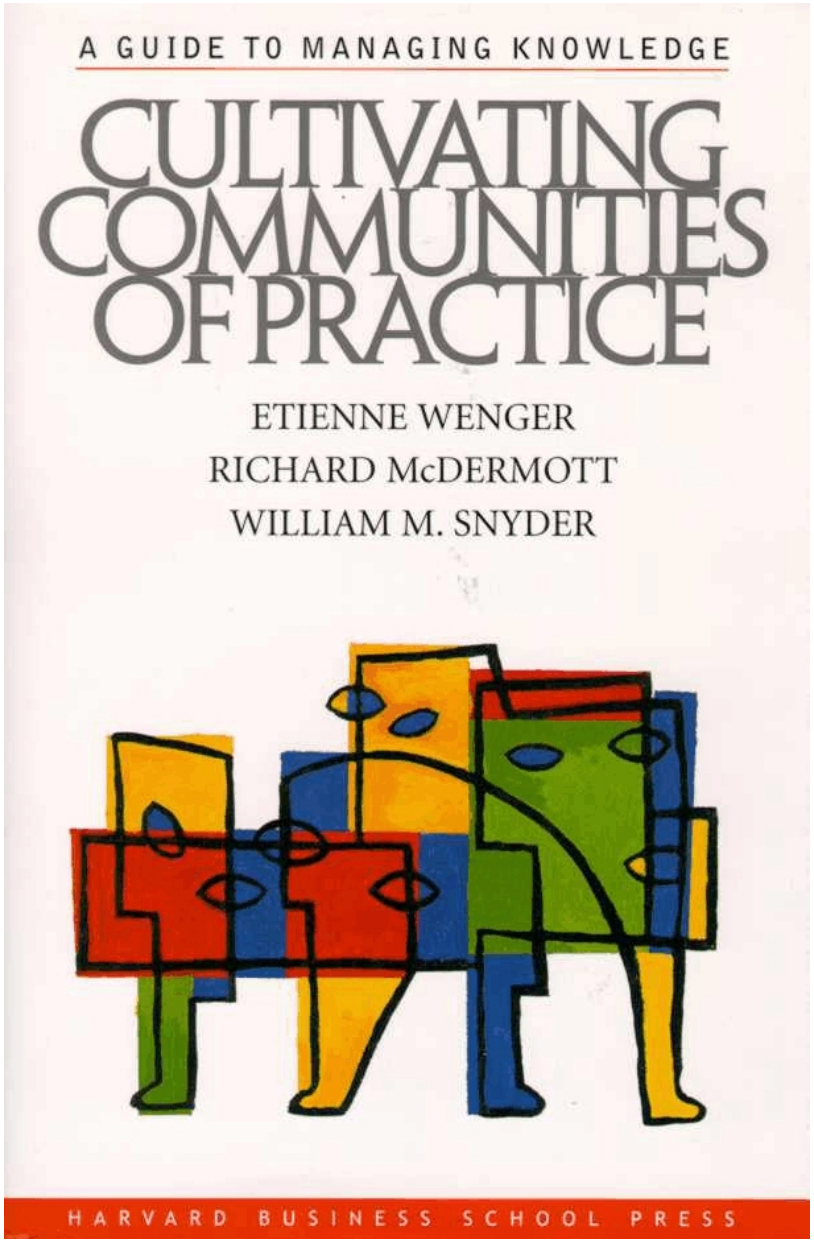
Lave, J. & Wenger, E. 1991. *Situated learning: Legitimate peripheral participation.* Cambridge University Press.



Communities of practice:

A group of people who:
- Share an interest in a topic (**Domain**),
- Interact and build relationships (**Community**)
- Share and develop knowledge (**Practice**).

Communities of practice: The organizational frontier -- *Harvard Business Review*, Jan/Feb 2000



Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.

Wenger, Etienne, McDermott, Richard, and Snyder, William. 2002. *Cultivating Communities of Practice*. Cambridge, MA: Harvard Business School Press.

Personal reflection on communities of practice
(After Wenger, 2002)

Talk about a community you belong(ed) to:

1. What were the characteristics that made it special?
2. Why did you join? What made you stay? What made you leave?
3. How did it affect you...your identity, your knowledge, your performance?

Communities of Practice are important for building Social Capital

”The norms and social relations embedded in social structures that enable people to coordinate action to achieve desired goals” – World Bank

“Social capital refers to features of social organizations such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit” – Robert Putnam

“Social capital consists of the stock of active connections among people: the trust, mutual understanding, and shared values and behaviors that bind the members of human networks and communities and make cooperative action possible” – Don Cohen & Laurence Prusak

Investing in Social Capital

Making connections

Enabling trust

Fostering cooperation

Cohen, Don & Prusak, Laurence. 2001. “How to invest in social capital.” *Harvard Business Review*, June, 86-93.
Cohen, Don & Prusak, Laurence. 2001. *In good company: How social capital makes organizations work.* Cambridge, MA: Harvard Business School Press.

Age of Interdependence

Tom Boyle of British Telecom calls this the age of interdependence; he speaks of the importance of people's NQ, or network quotient – their capacity to form connections with one another, which, Boyle argues is now more important than IQ, the measure of individual intelligence.

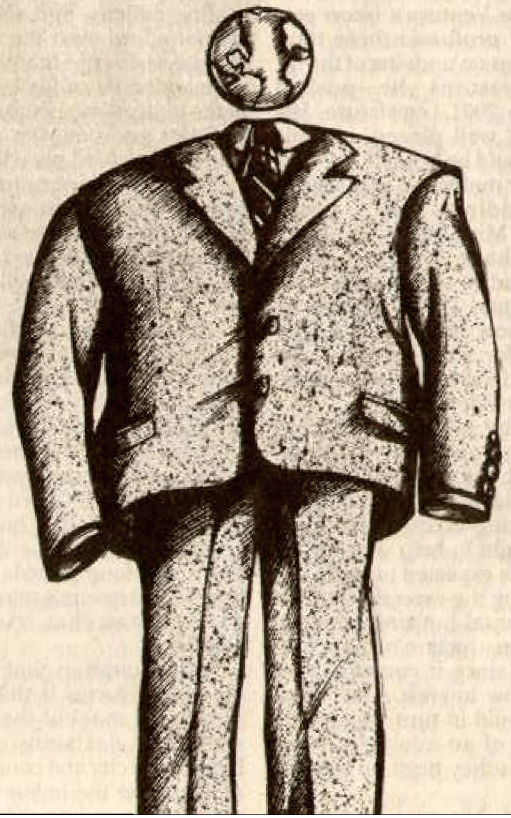
Cohen, Don & Prusak, Laurence. 2001. *In good company: How social capital makes organizations work.* Cambridge, MA: Harvard Business School Press.

Opinion

A selection of voices from the community, nation and world

Living in an interdependent world

Former President Bill Clinton addresses the question: Is the age of interdependence going to be good or bad for humanity? He thinks it will turn out to be good — but he cautions that the West must help those who are being left behind.



By William Jefferson Clinton

NEW YORK — The great question of this new century is whether the age of interdependence is going to be good or bad for humanity. The answer depends upon whether we in the

Fourth, from a political point of view, you might have said the dominant factor of the 21st-century world will be the explosion of democracy and diversity.

For the first time in the history of humanity, more than half of the

Whole Earth, Winter 2002

Mitakuye Oyasin

"We are all related"

Education is an art of process, participation and making connection.

Albert White Hat, Sr. & Cheryl Medearis
Sinte Gleska University, Rosebud, SD

Backward Design

Karl A. Smith

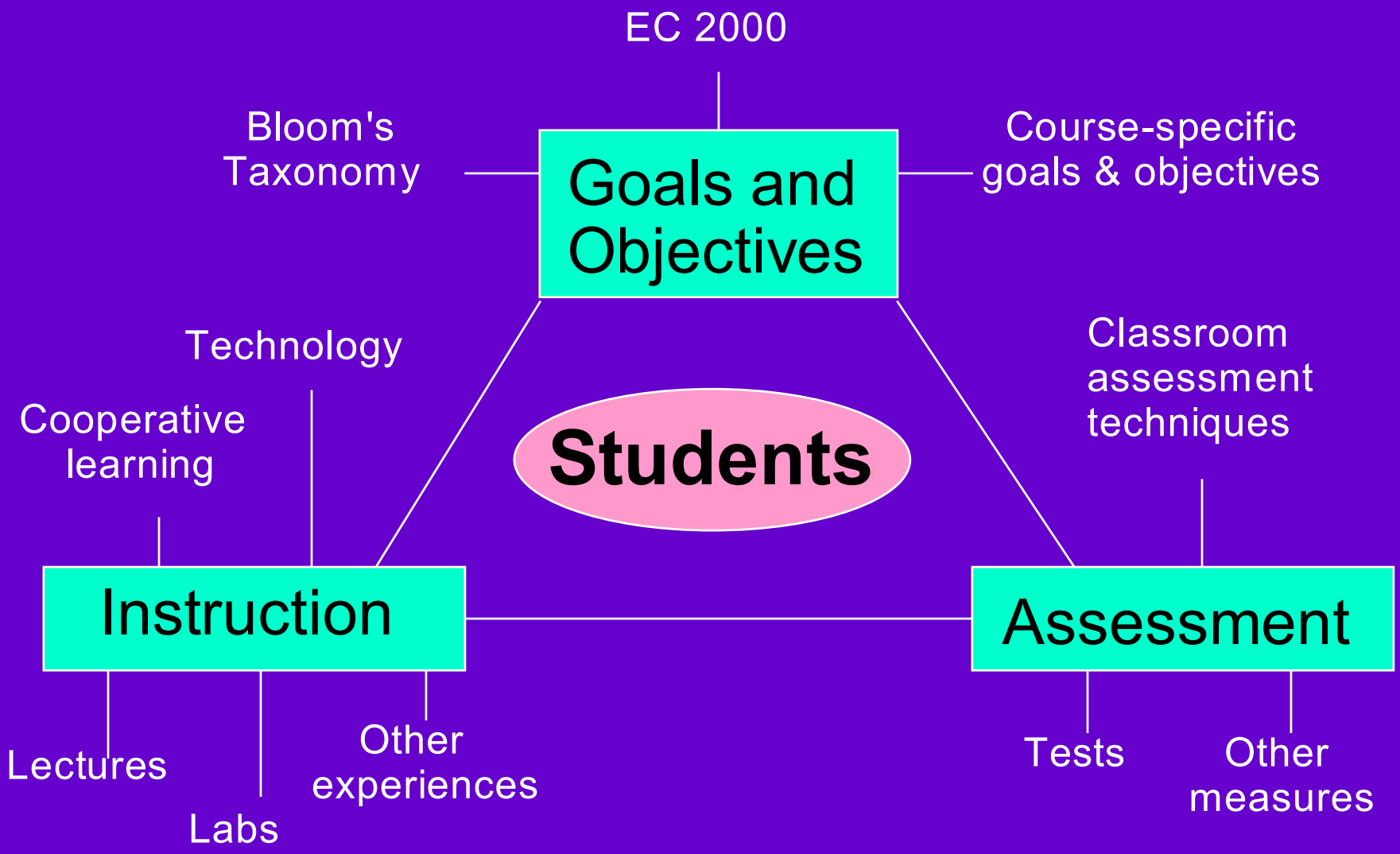
Course Design & Redesign

- Felder & Brent – Course Design
- Wiggins & McTighe – *Understanding by Design*

"We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great difference."
John Dewey, 1906

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

Effective Course Design



Felder & Brent, 1999

Wiggins & McTighe
Understanding by Design[1]

- Design (vb) – To have purposes and intentions; to plan and execute (Oxford English Dictionary)
- Backward Design
  - Conceptual framework, design process, and accompanying set of design standards
  - A way to design or redesign any curriculum to make student understanding more likely

Wiggins, G. & McTighe, J. 1998. *Understanding by design*. ASCD.

Backward Design

Stage 1. Identify Desired Results

Stage 2. Determine Acceptable Evidence

Stage 3. Plan Learning Experiences and Instruction

Backward Design

Stage 1. Identify Desired Results

Filter 1. To what extent does the idea, topic, or process **represent a "big idea" 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?**

Backward Design

Stage 2. Determine Acceptable Evidence

Types of Assessment:

Quiz and Test Items: Simple, content-focused test items

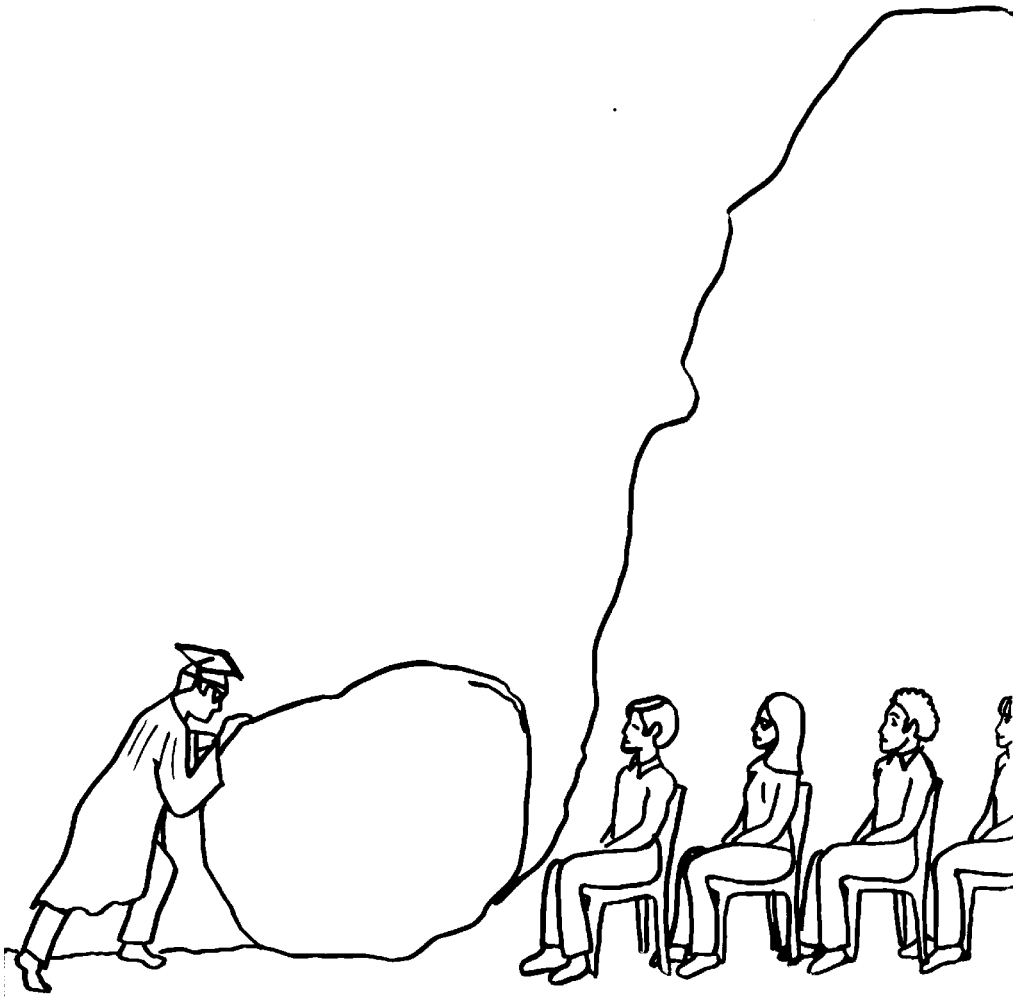
Academic Prompts: Open-ended questions or problems that require the student to think critically

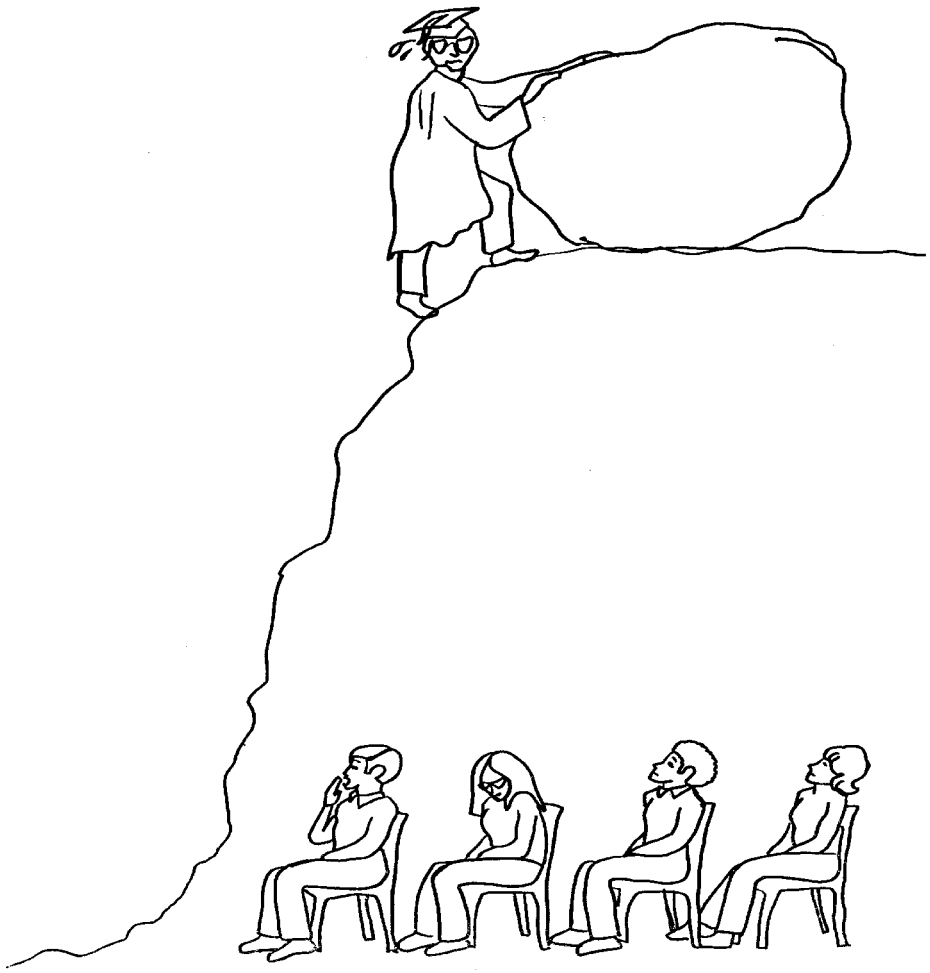
Performance Tasks or Projects: Complex challenges that mirror the issues or problems faced by graduates, they are authentic

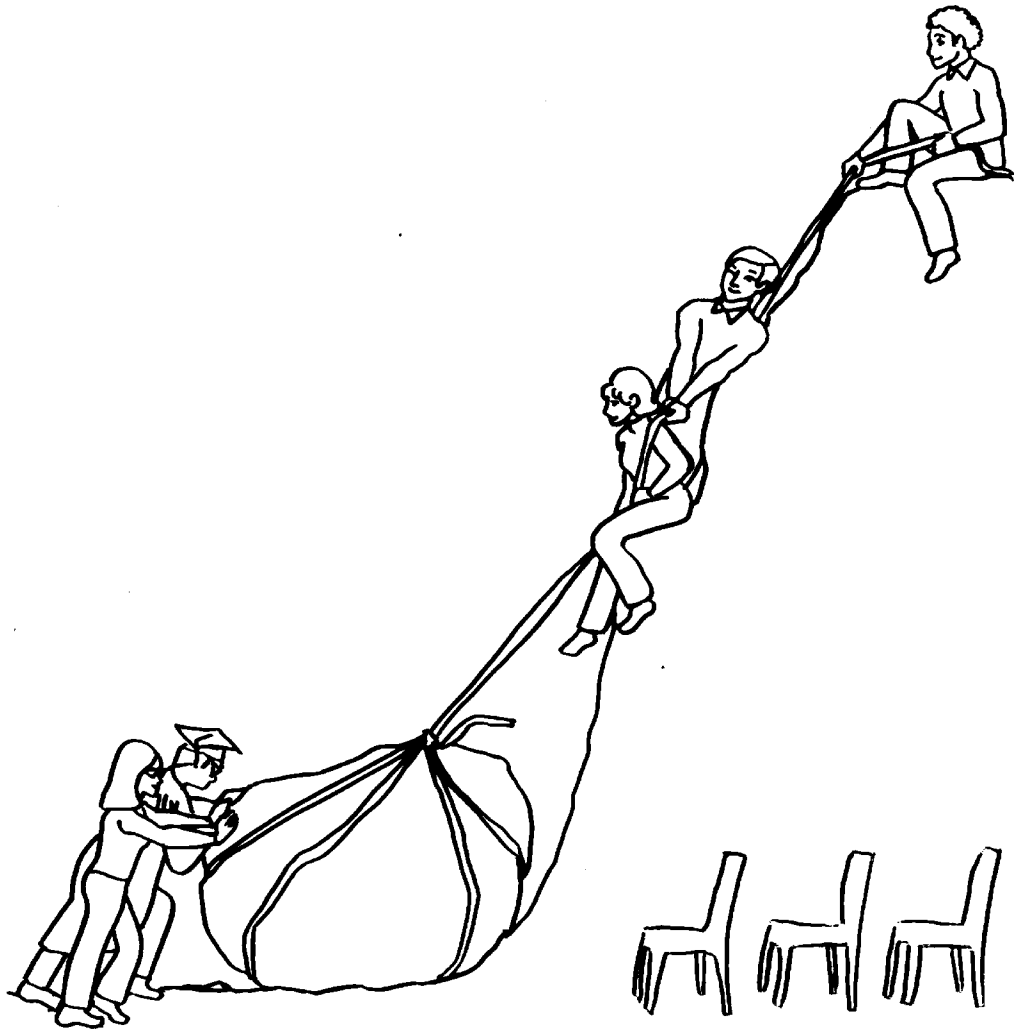
Backward Design

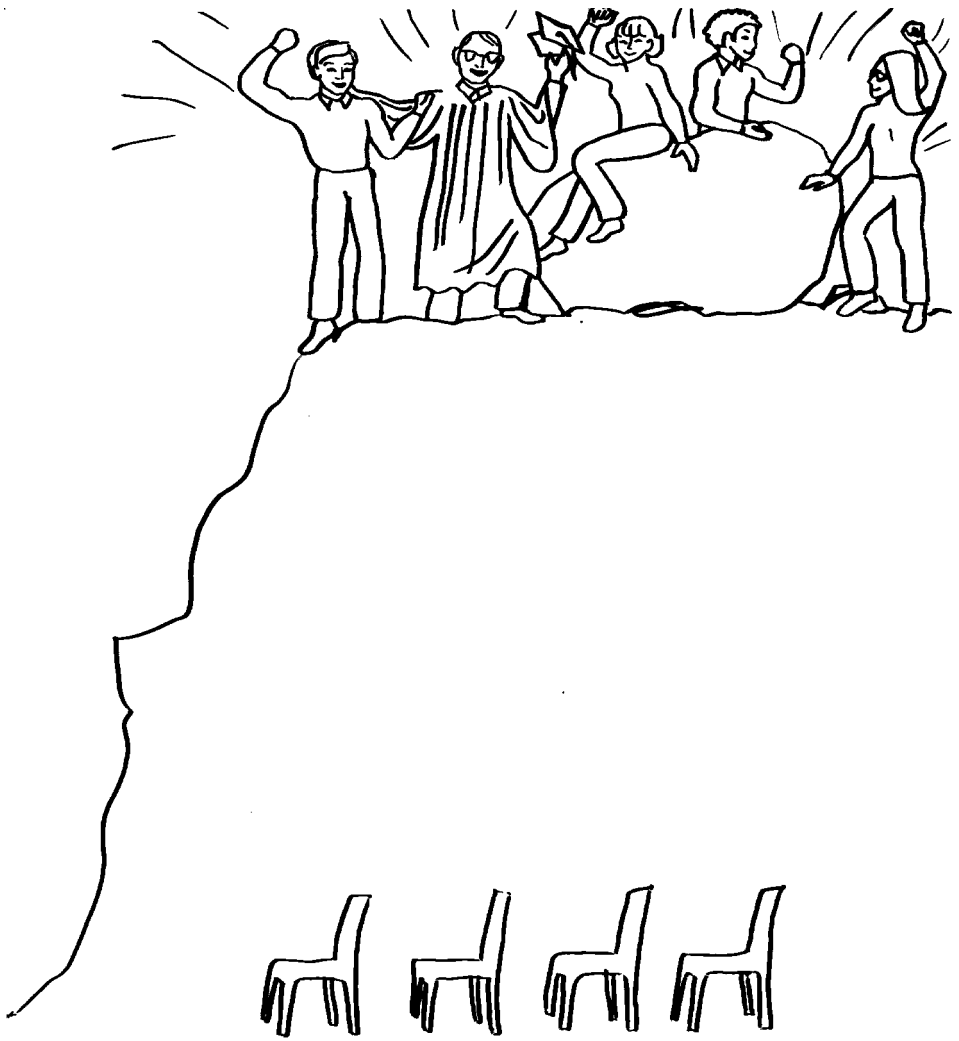
Stage 3. Plan Learning Experiences and Instruction

- 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?









Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine into flowers; the winds will blow their freshness into you and the storms their energy, and cares will drop off as Autumn leaves.

--John Muir