Linking Insights from How People Learn to the Process of Planning Undergraduate Learning Spaces

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Concordia University – St. Paul – October 22, 2010
21st Century Learning Outcomes

- Non-routine problem-solving
- Adaptability
- Complex social/communication skills
- Self-management/self-development
- Systems thinking

—Exploring the Intersection of Science Education and 21st Century Skills. NAS. 2010

How People Learn

People learn best when they are:

- actively engaged in constructing their own knowledge
- situated in a social and supportive community
- able to reflect and build on prior knowledge
- involved with addressing problems that are relevant to their lives and work.
Teachers:
• ...act as facilitators or coaches.
• ...use a ‘hands-on’ approach...to help students understand abstract concepts, solve problems, and develop critical thought processes.
• ...encourage collaboration in solving problems by having students work in groups to discuss and solve problems.
• ...[understand that] to be prepared for success late in life, students must be able to interact with others, adapt to new technology, and think through problems logically.

Transparent Beauty
By Robert L. Reid

The 163,000 sq ft extension to the Massachusetts Institute of Technology’s Media Lab provides a beautiful example of how a building’s design can promote interaction and collaboration among the people working within its walls.
Reflection and Dialogue

- Individually reflect on Building Design and Space Planning Practices that support and foster Interaction and Collaboration. Write for about 1 minute
- Discuss with your neighbor for about 3 minutes
  - Select one Practice, Insight, Success Story, Comment, Question, etc. that you would like to present to the whole group if you are randomly selected
- Whole group discussion

This is a book about the space of innovation. Some environments squelch new ideas; some environments seem to breed them effortlessly (p. 19).

What kind of environment creates good ideas? The simplest way to answer it is this: innovative environments are better at helping their inhabitants explore the adjacent possible .. (p. 36).

Our thought shapes the spaces we inhabit, and our spaces return the favor. The argument in this book is that a series of shared properties and patterns recur again and again in unusually fertile environments (p. 20).
Where Good Ideas Come From
seven shared properties and patterns

- The adjacent possible
- Liquid networks
- The slow hunch
- Serendipity
- Error
- Exapation (type of borrowing – Stephen Jay Gould & Elisabeth Vrba, 1971, e.g., Gutenberg’s printing press – classic combinatorial innovation, more bricolage than breakthrough)
- Platforms

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]
Student Engagement Research Evidence

• Perhaps the strongest conclusion that can be made is the least surprising. Simply put, the greater the student’s involvement or engagement in academic work or in the academic experience of college, the greater his or her level of knowledge acquisition and general cognitive development ...(Pascarella and Terenzini, 2005).

• Active and collaborative instruction coupled with various means to encourage student engagement invariably lead to better student learning outcomes irrespective of academic discipline (Kuh et al., 2005, 2007).


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 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

Active and Cooperative Learning

At MIT, Large Lectures Are Going the Way of the Blackboard

January 13, 2009—New York Times

January 2, 2009—Science, Vol. 323
www.sciencemag.org

Calls for evidence-based promising practices
TEAL
Technology Enhanced Active Learning

http://web.mit.edu/edtech/casestudies/teal.html#video

http://www.ncsu.edu/PER/scaleup.html
### The American College Teacher: National Norms for 2007-2008

<table>
<thead>
<tr>
<th>Methods Used in “All” or “Most”</th>
<th>All – 2005</th>
<th>All – 2008</th>
<th>Assistant - 2008</th>
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<tbody>
<tr>
<td>Cooperative Learning</td>
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<td>Grading on a curve</td>
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</tr>
<tr>
<td>Term/research papers</td>
<td>35</td>
<td>44</td>
<td>47</td>
</tr>
</tbody>
</table>


### High Performance Teams
Top Three Main Engineering Work Activities

**Engineering Total**
- Design – 36%
- Computer applications – 31%
- Management – 29%

**Civil/Architectural**
- Management – 45%
- Design – 39%
- Computer applications – 20%

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Most Important Skills Employers Look For In New Hires

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

- Teamwork skills: [ ] 64%
- Critical thinking/critical reasoning: [ ] 42%
- Oral/written communication: [ ] 38%
- Ability to analyze/organize information: [ ] 21%
- Innovative thinking/creativity: [ ] 20%
- Able to work with numbers/statistics: [ ] 5%
- Foreign language proficiency: [ ] 3%
- Recent grade(s): [ ] 38%

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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)

Professional Skills  
(Shuman, L., Besterfield-Sacre, M., and McGourty, J., “The  
ABET Professional Skills—Can They Be Taught? Can They Be Assessed?”  
Characteristics of High Performing Teams

• SMALL NUMBER

• COMPLEMENTARY SKILLS

• COMMON PURPOSE & PERFORMANCE GOALS

• COMMON APPROACH

• MUTUAL ACCOUNTABILITY

--Katzenbach & Smith (1993)
*The Wisdom of 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.
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
Teamwork Skills

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

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._________ 3._________
2._________ 4._________
## Group Processing Plus/Delta Format

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

## Design and Implementation of Cooperative Learning – Resources

- **Design Framework** – How People Learn (HPL) & Backward Design Process
- **Content Resources**
- **Active and 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](http://www.ce.umn.edu/~smith)
- **Other Resources**
  - University of Delaware PBL web site – [www.udel.edu/pbl](http://www.udel.edu/pbl)
**Skills: Hard Workers**

*From Boeing Aircraft Group Team Member Training Manual (Excerpts):*

- EVERY member is responsible for the team’s progress and success.
- Listen to and show respect for the contributions of other members; be an active listener.
- CONSTRUCTIVELY criticize ideas, not persons.
- Only one person speaks at a time.
- Everyone participates; no one dominates.
- Be succinct—avoid long anecdotes and examples.
- No rank in the room.
- Ask questions when you do not understand.
- Attend to your personal comfort needs at any time, but minimize team disruption.
- HAVE FUN!!

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...by interacting on an ongoing basis.

— Wenger, etal. Communities of Practice. 2002

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**Skills: Systems Thinkers**

*Leadership is present where we find people working together believing their cooperative efforts will lead to improvements in the system for everyone and to systemic change.*
Reflecting Communities

Consider the experience of dancing on a dance floor in contrast with standing on a balcony and watching other people dance... To discern the larger patterns on the dance floor...we have to stop moving and get to the balcony.


2009/2010 Reports

Preparing the Next Generation of STEM Innovators: Identifying and Developing Our Nation’s Human Capital

Transitions and Tipping Points in Complex Environmental Systems
What students are able to do
What students are able to be

Motivated
Prepared
Focus on the future
Equipped
Brielle
Passionate
Engaged
Leaders
Systems thinkers

Visionary
Butterfly
Boundary-crossers
Hard Workers
Accountable
Reflect
Connected
Communicate
FAIL

The PKAL Vision
The Ideal Learners