Collaborative Problem Solving: Selected Parables

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An Opinion up Front

I don’t know of any way of organizing classroom instruction with more (positive) impact on student learning in the classroom than collaborative problem solving.
A Spectrum

• Wide range of collaborative arrangements:
  – Brief (a few minutes) and informal
  – Semester-long, carefully structured & supported
  – Everything in between

• Lots of compelling literature and helpful how-tos out there
The (My) Early Years: 1989

• Started teaching by lecturing
  – Didn’t work very well

• Oct. 17, 1989: Loma Prieta earthquake (6.9)
  – Campus closed a week: chance to reflect

• Introduced “Thought Questions” and invited students to respond
  – Scaffolding: pre-class reading assignment only
  – Little or no other pedagogical organization
  – Same 3-4 students always responded
  – Far more fun than lecturing
  – Awful performance on multiple choice tests
An Important Event: 1992

• Half-day campus seminar:

Roger Johnson, University of Minnesota
“Collaborative Learning in the College Classroom”

• I went: Self-motivated professional development
An Application & Revelation

• In class, I put students in small groups (3 people)
• Assigned spokesperson
• Asked groups to develop responses to my “Thought Questions”
• Asked for responses (no other new scaffolding)
• To my surprise:
  – I could leave the room, and from the hallway hear a roar of engaged students:
    learning was taking place without me!
  – Scores on multiple-choice tests became somewhat, but noticeably, less awful!
A Tentative Conclusion

More than anything else that I’d tried, small-group collaborative learning:

• improved the learning experience for my students
• and for me

and apparently

• improved student performance on assessments
Confirmation

One recent example from the literature:

Smith et al. (Jan 2, 2009), Science, “Why Peer Discussion Improves Student Performance on In-Class Concept Questions”

When students answer an in-class conceptual question individually using clickers, discuss it with their neighbors, and then re-vote on the same question, the percentage of correct answers typically increases....

Our results indicate that peer discussion enhances understanding, even when none of the students in a discussion group originally knows the correct answer.
The Other Extreme: 2002

- NSF-CCLI grant: “An Inquiry and Standards Based Earth System Science Course for Pre-service K-8 Teachers and Others”
  - Third & fourth year, non-science majors
  - Problem-based learning (PBL) strategy:
    - Real-world problems [local], plus
    - Structured collaborative learning
Our Collaborative Learning Holy Book

ACTIVE LEARNING:
Cooperation in the College Classroom

DAVID W. JOHNSON
ROGER T. JOHNSON
KARL A. SMITH

Interaction Book Company
What is the best way to form a small collaborative group in class?

A. Less capable with more capable students in the *same* group
B. Less capable and more capable students in *separate* groups
What is the best way to form a small collaborative group in class?

A. Male and female students separately

B. Male and female students in same group

C. Male and female students in same group, as long as male students are not the majority

*Results culturally dependent; culture can vary over time?*
What is the best way to form a small collaborative group in class?

A. Students with similar knowledge/interests in same group

B. Students with different but complementary knowledge/interests in same group

C. Random group assignments

D. Students decide themselves
What is the best way to form a small collaborative group in class?

A. Students with similar knowledge or interests in same group
B. Students with different but complementary knowledge or interests in same group
C. Random group assignments
D. **Students decide themselves**
Group Structure: Roles

- Spokesperson
- Recorder (note taker)
- Monitor
  (keeps group on task, watches time)
- Etc.
Assigning Roles

Based on:
- month and day of birth
- who lives closest/farthest away
- alphabetical by first name
- etc.

Also serves as icebreaker/introduction
- more comfortable working together

Rotate roles
- chance to experience/practice all roles
Collaborative Learning Pushed Hard

• Assigned Teams: Based only on previous geoscience course (geology, oceanography, meteorology, astronomy)

• Ice-breaker (first day)

• Get student buy-in (sell PBL approach right away)

• Real-world problem design:
  – Require unique contribution from each team member
  – Students teach other team members what they learn

• Grading:
  • Shared group grade (*incentive to work together*), plus
  • Grade on individual contribution (*individual accountability*)
  • Did this for exams, too
Collaborative Learning Pushed Hard

- Support for group functioning
  - Group-function roles assigned (and rotated)
  - Some instruction on how to collaborate effectively
  - Provided structured opportunities for peer feedback
  - Mediated disputes if necessary
  - Reorganized groups only as last resort
Lessons Learned

• Group functioning and maintenance are non-trivial
  – Developing collaborative skills needs to be a learning objective of the course

• Group dynamics can be mind-blowingly powerful
  – In both positive and less positive ways
  – Either way, students & instructors learn a lot about themselves and human nature

A successful team taking the final exam
An Interesting, Low-Commitment Application

• Observation: Intro students aren’t very good at reading and understanding assignment instructions

• A possible solution, from Johnson, Johnson, & Smith (1991)
  
  – Informal (temporary) groups: “Read and Explain Pairs”
  
  – Task: Read and understand assignment instructions
  
  – Procedure:
    
    • Read assignment instructions individually
    • One person explains part of them to the other, who paraphrases it back
    • Reverse roles for the next part; etc.
    • Share uncertainties with class as a whole