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 (< one class period), informal
  – Semester-long, carefully structured & supported

• 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 pedagogical organization
  – Same 3-4 students always responded
  – Way 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)
• Asked them to work out responses to the “Thought Questions”
• Asked for responses (no other new scaffolding)
• To my surprise:
  – I could leave the room for a few minutes, and a roar of engaged students could be heard from the hallway: *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 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 revote 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”
  – Upper-division, non-science majors
  – Full-out problem-based learning (PBL) strategy
    • Real-world problems (local) plus structured collaborative learning
Collaborative Learning Pushed Hard

• Assigned Teams: Based only on previous geoscience course (geol., oceanog., meteor., astron.)

• Ice-breaker (right away)

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

• Problem assignments
  – Require unique contribution from each team member
  – Students teach the other team members what they learn

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

• Support for group functioning
  – Group-function roles assigned (and rotated)
  – Instruction provided 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 directions
  – 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