Student group work in educational settings
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Although group work is sometimes hailed as an educational panacea, the realities are considerably more complex. Many studies of group work have been done, and they show a wide variety of results. These range from dramatic improvements in student learning and satisfaction to negative impacts on both. The potential benefits of social interaction on learning are readily apparent. Who has not understood a topic better through explaining it to a colleague and/or having that person raise questions about an explanation? Also, in many situations, peers can provide an effective low cost substitute to individualized instruction by the teacher. However, achieving these and other benefits, such as learning teamwork skills, do not come automatically, and there are clear potential downsides to group work, including the time for organizing groups and dealing with intra-group problems, potential student resentment, more complex grading policies, and difficulties in scheduling and room layout. To achieve the maximum benefit from group work, an instructor must carefully consider the desired educational goals and the benefits, tradeoffs, and pitfalls of introducing different types of collaborative work, and then choose the most suitable type.

Here we briefly review different levels of group work and list the potential benefits and negatives, and what requirements research has shown are needed to ensure a high probability of success.

Levels of collaborative activity – Benefits, Requirements for success, and Negatives

1. Multiple, brief small group discussions in class.
(in response to challenging instructor questions or in-class assignments)
A. Benefits: Learn through explanations to others, learn metacognitive skills through analyzing other's reasoning, learn jargon through use in discourse, learn to carry out scientific discourse. Peers provide low level help and feedback, such as catching arithmetic mistakes and avoiding "getting stuck". The stress of speaking in class is reduced, particularly if student is asked what their *group* thought.
B. Requirements: Incorporating this in class is relatively easy – just provide some reason for students to discuss the material with each other. Implementation needs to include some minor reward system or class expectation to promote the group discussion, because otherwise it will not happen spontaneously for many students. Group size should be small (2-4). Two low-effort options for group formation that enhance interaction over just "talk to your neighbour" are: 1) instructor randomly assigns, or 2) students self-organize and register their group online. Such formal groups particularly enhance interaction if students are occasionally required to provide group consensus answers. While it is preferable to have a range of backgrounds and levels in each group, the benefits in this setting are usually not considered large enough to be worth the effort. The benefits are primarily from avoiding groups composed solely of low motivation and low ability students. With mixed groups, the better prepared students can provide explanations to the weaker students, with benefit to both.
C. Negatives: Minor. Time needed to form student groups. Potential disruption due to off-topic discussions in class (usually minor).
D. Other: Opinions vary, but we recommend keeping group composition stable, except where problems.

2. Informal, out-of-class study groups.
A. Benefits: Like 1A, plus students can study more effectively by getting low to moderate level feedback from each other. This avoids wasting time from "getting stuck" or overlooking trivial mistakes. Students can succeed at more challenging and complex assignments. Students may find course work more satisfying and enjoyable, and learn teamwork skills.
B. Requirements: Minor. Regularly encourage and discuss the benefits of study groups. Ensure that marking/grading scheme does not appear to penalize collaboration, as discussed below. Provide some form of both group and individual incentives. For example, collaborating can improve grades on assignments, but there are also exams that are closely aligned with assignments. Assignments must be challenging to draw students into meeting for study groups. Make it logistically easy and not socially challenging to form into groups. For large classes, this likely will involve scheduling a room and time for

students to meet and/or website for connecting up. Having instructor or TA at these study sessions can draw more students, but it is important that the instructor/TA does *not* provide the answers.
C. Negatives. Negligible. Time needed for elements of B.

3. Formal in-class group activities (such as tutorials, concept mapping, labs, …)
A. Benefits: Same as #2, but involves all students. Plus students can develop more teamwork skills.
B. Requirements: Best to have a challenging activity where students work with ideas that are typically difficult to learn and the activity requires them to think about and debate these ideas with each other. Need course structure and space conducive to group work (4/table works well). TAs with role of facilitating group discussion and Socratic teaching works well. Grading options include: only for participation, grading individual work, or grading collective work. Be explicit about why and how collaborative learning is beneficial. If grading collective work, need time and attention devoted to why and how to work in teams effectively, roles and responsibilities of team members, and evaluation of contributions as part of team. Often rotating roles are assigned, manager, recorder, sceptic, etc.
C. Negatives. Time and personnel needed to organize facilities and groups.

4. Formal in or out-of-class collaborative assignments- collective group work and shared marking
A. Benefits: Same as #3, plus reduces time for marking assignments.
B. Requirements. Similar to #3, and a significant goal of the course should be to have students learn to work in teams. Assignments must encourage teamwork, such as being sufficiently difficult or complex that is easier to set up team and work together than to complete as an individual. Assignments that require judgement decisions are found to be most effective at encouraging diverse participation. Groups should be formed by the instructor in a manner that assures equal diversity and skills across groups and is perceived to be scrupulously fair. There must be timely feedback on the functioning of group and a process for dealing with intra-group squabbles.
C. Negatives. 1) There will be some level of student resentment and intra-group disagreements over credit and level of effort. 2) Time required to create groups and deal with logistics. In many courses, groups will not spend the 40 hours of interaction that has been cited as needed to have a highly effective team. 3) Instructors who are not experienced in implementing this can find it difficult to obtain good results.
D. Other. Group size 4-5 is considered optimal, with all visibly under-represented minority students in a group with at least one other minority student.

5. Learning with fully developed teams.
A. Benefits. Same as #4, plus students learn to work as part of team to solve problems and manage projects that would usually be impossible for an individual to complete.
B. Requirements. Major part of course goals needs to be learning teamwork. All of #4B, plus requires more attention to group size, composition, task assignment, general group interaction, and reward system. Majority of course should be team based project(s). More time and attention devoted to why and how to work in teams effectively, roles and responsibilities of team members, and evaluation of contributions as part of team. Teams should have at least 5 and preferably 6 or 7 members, and the composition should be as diverse as possible.
C. Negatives. Similar to #4, plus significant time required to create good team-based learning projects.

Group work and marking/grading scheme.
If student marks depend on relative student ranking ("grading on curve", "normed", etc.) there is a clear disincentive for a student to collaborate with other students. The inherent contradiction between telling students that they must collaborate, while at the same time penalizing them for helping other students through the marking scheme, will always result in student discomfort and resentment.

Posted at http://www.cwsei.ubc.ca/resources/instructor_guidance.htm

This document is based on research findings. Below is a selection of references on group learning.

References

C. Crouch and E. Mazur, Peer Instruction: Ten years of experience and results, American Journal of Physics, V. 69, pp 970-977 (2001).
> A good review of Peer Instruction (falls under Level 1 in this document), including a description of the method and data on effectiveness for improving student learning.

P. Heller and M. Hollabaugh, Teaching problem solving through cooperative grouping. Part 2: Designing problems and structuring groups, American Journal of Physics, V. 60, pp. 637-644 (1992).
> A good reference on structuring and managing cooperative groups.

M. Prince and R Felder, The Many Faces of Inductive Teaching and Learning, Journal of College Science Teaching, V. 36 no. 5 (March/April 2007) p. 14-20.
> A nice overview of various forms of inductive teaching that discusses both group and non-group approaches, benefits, and ease (or difficulty) of implementation.

Team-based Learning: A Transformative Use of Small Groups, edited by Larry K. Michaelsen, Arletta B. Knight, and L. Dee Fink, Stylus Publishing, Sterling VA. (2002).
> A good reference on Team-Based Learning and also a good reference on group dynamics (Chapter 4 by C. Birmingham and M. McCord is on research on group dynamics.)

http://teambasedlearning.apsc.ubc.ca/
> UBC Faculty of Applied Science website on Team-Based Learning