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Getting Started: Informal Small-Group Strategies in Large Classes

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> I got started with discussion pairs in chemistry about ten years ago when I took over teaching the big introductory classes of several hundred students. I got started gradually by working a problem with the students and then giving the students one to work on themselves together with their neighbors sitting next to them. Now these activities underpin every class I teach. What propelled me into this was watching colleagues in lecture working a problem on the board: I saw it going into the students' eyes, down their arms and into their notebooks, but their *understanding* of the problem was bypassing their brains! Over and over, I saw the students not be able to do similar problems in the tutorial the very next day [Helen Place, personal interview with the authors, Sept. 1998].

Helen Place and dozens of other teachers of large classes are finding great success in using informal, small-group strategies in class—that is, short in-class discussions of the turn-to-your-neighbor variety that begin or end the lecture or punctuate it at key points along the way. Students are given a question or problem to consider or work through, discuss with a neighbor, and sometimes report back to the class as whole. Through these short activities, which usually take only a few minutes of class time, students can check their understanding, prepare for the lecture to come, or refocus on material just presented. As they listen in on these conversations, teachers and teaching assistants can check student understanding as well.

Interest in the use of informal, small-group strategies has grown at a rate that outstrips even the very significant growth in more formal small-group procedures (Kagan, 1994). Such work with pairs or teams is easy to

implement because faculty members do not need to spend significant time devising ways to create groups or developing and coaching effective group dynamics over time. Usually there is no expectation of work to be turned in, so the teacher is not concerned with grading collaborative student work. Teachers with strong concerns about content coverage often prefer these short, informal strategies because they consume, at most, just a few minutes of their lectures.

We believe that turning over a relatively small percentage of the total in-class instructional time to informal small-group work can produce a large "bang for the buck" in making conventional lecture-centered formats more engaging for students and more productive for their learning. With these brief activities, there is little risk that teachers will lose control of their classes or encounter other forms of student resistance, an objection faculty sometimes raise against more formal small-group procedures. Once instructors have experienced success with informal strategies, they are often more inclined to commit to more elaborate small-group approaches.

A large number of informal cooperative and collaborative approaches have been identified (Kagan, 1994). In this chapter we describe a few of the most popular. We also identify critical points when these strategies might be used in class. A powerful argument for informal strategies is that they can be used in virtually any course or discipline, in introductory as well as advanced classes, and at many stages of the instructional sequence.

Examples of Informal Small-Group Strategies

Probably the most popular and influential of informal small-group approaches is think-pair-share (Lyman, 1981). In this strategy the teacher lectures for a period of time, then poses a question, test item, or issue for students to consider in brief individually (the think phase). Then, individuals turn to others sitting nearby and share their responses with another person (the pair phase). If time permits, several of the pairs share their responses with the class (the share phase).

In the think phase of think-pair-share, it is entirely possible that 100 percent of the learners are simultaneously engaged in active thinking. In the pair phase, there is the potential that at any given moment, 50 percent of the students are actively engaged in talking and problem solving. Compare this with the lecture technique, where it is often only the teacher who is engaged in active academic effort. An additional benefit of think-pair-share is that it is a natural classroom assessment technique, or CAT (Angelo and Cross, 1993). Using think-pair-share not only engages learners in what can be higher-order thinking but also provides an immediate gauge of the degree and quality of student understanding of course content. Teachers can then shape the remaining lecture time based on this feedback. At the same time, students are getting immediate and explicit feedback on the strength or weakness of their understanding. Prompt and descriptive feedback has been

identified as one of the best predictors of powerful teaching and learning (Walberg, 1984; Chickering and Gamson, 1987).

A variation of think-pair-share is think-pair-square, where pairs of students share their information within teams of four rather than with the class. This strategy can be a more efficient use of class time in that the last phase of the technique tends to engage more students in active learning and conversation than the share phase of think-pair-share, where only one student at a time is reporting out to the class.

Many other informal small-group techniques are variations of think-pair-share. For example, Eric Mazur (1997), professor of physics at Harvard, has developed ConcepTests, which he integrates into his peer instruction teaching approach. About every fifteen to twenty minutes, Mazur poses a multiple-choice (ConcepTest) question that requires conceptual understanding (such as estimating the displacement of a toy boat in a bathtub). Students write their answers on a sheet and identify their levels of confidence in the answer. Then they work in pairs, attempting to convince others of their answers. Students then answer the question a second time and report their confidence levels again. Mazur then polls the whole class about their answers and uses this information in structuring the remainder of the lecture. Mazur has collected data on the impact of his approach on several outcome measures. He found that students who had ConcepTests within the lecture performed better on course exams and also scored higher on measures of traditional problem solving and conceptual understanding than students in traditional lecture classes. (See Chapter Six for Mazur's physics Web site address and that of a related University of Wisconsin chemistry Web site.)

Robert Webking's approach to teaching political science at the University of Texas, El Paso, described in Chapter One, was adapted from Mazur's ConcepTest. Michael Zeilek at the University of Northern New Mexico uses the technique in his astronomy class of several hundred. The polling of the class can be done after individual work or after pairs have compared answers. We believe that all students should be encouraged to commit publicly to an answer because letting students "off the hook" defeats the purpose of the class poll.

Susan Prescott Johnston and Jim Cooper (Johnston and Cooper, 1997) have extended Lyman's think-pair-share approach by identifying the cognitive outcomes to be developed within a class, then structuring their small-group strategies, called Quick-thinks, to assess these outcomes in order to teach them clearly and directly. Thus, it is both a teaching technique and a classroom assessment strategy. Here are some examples of Quick-thinks:

- *Reorder the steps:* Students must correctly order a set of randomly sequenced steps.
- *Paraphrase the idea:* Students are asked to explain something in their own words, often to a specific audience, such as another student, a parent, or

a client. This calls for cognitive elaboration skills as students explain the idea to others, a skill strongly related to deep learning.
- *Correct the error:* Students find the error in an inaccurate statement, a weak argument, or an illogical conclusion.
- *Support a statement:* Students must support a statement made by the teacher, using a variety of sources, which might include lecture notes, homework assignments, life experience or library research.
- *Select the response:* This a multiple-choice format similar to Mazur's ConcepTest.

Johnston and Cooper have presented these strategies to several hundred faculty members in the last two years and report that faculty in virtually all disciplines find one or more of them to be of immediate use. The approaches do not require elaborate planning, careful introduction, or coaching of students, which might be needed in more formal procedures, but they should be carefully planned and implemented, like any teaching strategy.

Another informal assessment strategy is the minute paper. As described by Robert Wilson at Berkeley (Wilson, 1986), the minute paper involves having students answer two questions in the last one to three minutes of class. One frequent question is, "What was the most important thing you learned during this class?" Another frequent question is, "What issue or concept remains muddy, or raises questions for you?" Minute papers can be used at the beginning of class in reference to homework assignments, in assessing what reading material was clear and what was not, or as a prompt for a think-pair-share activity at the end of class to identify what was clear and what was unclear about the lecture.

Psychologist Donald Dansereau at the Texas Christian University uses a highly structured approach to small-group instruction, which he calls scripted cooperative learning. After fifteen to twenty minutes of lecture, students are paired by the teacher so that teammates vary from one class session to the next. Students review class notes, taking turns as recaller-summarizer and checker. The recaller summarizes the content of the prior lecture segment and the checker assesses the summarizer's accuracy and detail. After determining the accuracy of the notes, students jointly work on developing strategies that will help them remember the content, such as constructing examples and developing mnemonic or memory devices to assist in long-term retention.

Dansereau has also examined the use of concept maps to aid in understanding and retaining content. Concept or knowledge maps are two-dimensional networks that interrelate important concepts (O'Donnell, 1994). They draw the student's attention to the overall structure of the lecture, often reducing the complexity of learning the lecture material by creating visual images of key topics and ideas and key relationships among them.

Using rigorously designed, short-term studies, Dansereau, Angela O'Donnell, and their colleagues (O'Donnell and Dansereau, 1992) have amassed a significant amount of data that indicate that their procedures result in better performance on a variety of cognitive and affective outcome measures (many relating to technical and scientific information) and transferred to individually completed tasks. They assert that teacher-structured small-group work produces better outcomes than student-structured pair activities. There is considerable difference of opinion (and sometimes outright debate) about how structured small-group work should be, and who (teachers or students) should be responsible for deciding how the given problem or intellectual task should be attacked. Our view is that these design choices depend on a variety of factors, including the course, level, discipline, teacher, specific learning outcomes, students' prior experience with small-group learning, and the point in the sequence of instruction.

Applications of Small-Group Approaches

Small-group approaches can be used successfully in many different ways.

Launching Class in Discussion. Small-group work can be used at the beginning of class to provide students with a motivation hook or an anticipatory set for what is to follow. In Jim Cooper's lecture on sampling, he often begins by asking students to "identify the error" in describing the *Literary Digest*'s presidential poll of 1936, which drew from a population that had telephones and car license plates (a sample of relatively affluent people during that Depression year). When Franklin Roosevelt won the election, and not Alf Landon (as the *Digest* had predicted), the practice of biased sampling of voters became a public scandal. Making this a simple Quick-think or think-pair-share activity serves to stimulate interest in a lecture on sampling theory—a boring topic for most students. To increase the likelihood that students do the reading, Robert Webking often gives ConcepTests on homework assignments at the beginning of his political science classes. He reports that his students begin to anticipate and prepare for ConcepTests and are thus better able to gain from the lecture and group work that are subsequently presented. As noted earlier, Helen Place launches her chemistry classes at Washington State University by displaying a problem on the overhead; students work through the problem and share answers with neighbors in the four-hundred-seat lecture hall, knowing that the lecture for the day will build on some concept underlying the problem. Faculty members who regularly start class with these kinds of activities report that the class feels more focused and attentive, with everyone thinking and talking about important course content right at the outset.

Breaking Up the Lecture for Comprehension Checks. As Craig Nelson (personal interview with the authors, June 1998), an Indiana University biologist puts it, these informal strategies "always work!" Although this

sounds a bit overconfident, Jim Cooper generally shares this view, with some obvious caveats. It has been Cooper's experience that after fifteen to thirty minutes of lecture—particularly in his graduate research methods class—the energy level and sense of involvement that follows from the most informal of small-group tasks always increases. When attention spans are waning and yawns are waxing, he often inserts a brief think-pair-share, even if it is only something as simple as "Think of two real-world examples of random sampling," or "Now that I have drawn two correlation scatter plots, you construct a third using the data that I am writing on the board."

Tony Grasha (psychology, University of Cincinnati), Brian Coppola (chemistry, University of Michigan), Craig Nelson (biology, University of Indiana), and Helen Place (chemistry, Washington State University) are among those who regularly use informal strategies midway through the lecture. These often serve as comprehension checks for students and as classroom assessments for faculty, allowing teachers to modify the next part of their lectures appropriately.

Closing Class with Small-Group Conversation. Too often, the last few minutes of class is spent in paper-shuffling and backpack-filling, behaviors not associated with high levels of student engagement. If students come to expect a brief classroom assessment during the last few minutes of class, this off-task behavior is reduced or pushed to the very last moments of class sessions. Minute papers are particularly helpful here. Then, if they are briefly scanned by the instructor before the next class meeting, students feel that they have a voice in the class and there is a sense of continuity from one class meeting to the next. Many faculty members reduce the number of minute papers they have to check by asking students to create them in pairs or teams.

Reviewing for Exams. We have found exam review to be one of the best uses of both formal and informal small-group work, particularly for instructors new to collaborative learning. Students are usually highly motivated because they will be tested on this material very soon. In fact, we have found that students often ask for additional problem sets to take home and often stay after class for long periods of time when they feel that understanding sample questions may result in increased test performance. Another variety of this reviewing-for-the-test strategy is to have students construct their own sample test problems. Then, in pairs and teams, students attempt to answer the questions or critique them for quality.

Debriefing Exams. Giving feedback to students on exams is one of the least pleasant parts of teaching. Debriefing exams in pairs or teams makes the process a learning experience. Often, better students can explain why an answer was inaccurate or incomplete in a way that is understandable and easier to accept than if comparable information is offered by professors. Pamela Robinson gives exams back in team folders. Students then spend a few minutes explaining their answers to teammates in groups of four. Students may only question their grades on the tests after they have engaged

in these discussions. Robinson reports that she gets very few complaints and that the few minutes during which small groups go over the exams is spent in high-level discussions about why answers are correct or incorrect.

Deepening Audiovisual Presentations. It is our experience that video, slide, and other AV presentations are too often used by students as opportunities to sleep or engage in other off-task activity. We have found that by involving students in brief informal work at the beginning and end of the presentations, they become more attentive and engaged. For example, in a sociology class students might be asked to predict the leading causes of prejudice or the most important influences on adolescent development, then check their responses after the film or video is shown. Or students might be given a set of questions to frame the video, then engage in team and whole-class discussion after it.

Predicting Processes and Outcomes of Demonstrations. Lorena Tribe, professor of chemistry at the University of Wisconsin-Madison, uses ConcepTests in her chemistry class of several hundred. She asks students to make predictions concerning the results of experiments, which often are vivid depictions of a chemical process. Following the experiment she has students assess their predictions. In a tape about ConcepTests produced by the university, students in her chemistry class are asked to predict if coffee will lose its color, taste, and smell when subjected to a distillation process. After pairs make their predictions, Tribe conducts the demonstration and has a pair of students taste the coffee to assess the accuracy of the predictions. This activity illustrates how an interesting demonstration can have even greater impact when combined with an informal small-group exercise.

A Period of Adjustment

Every teacher we spoke with commented that even for these short in-class tasks, there was a learning curve for the students, an adjustment time at the beginning of the term. Students are accustomed to sitting through lectures without extending themselves much to work problems or engage in complex-thinking tasks. So asking them to think hard about something, to work a problem, to make a choice, to discuss with a neighbor—all of this pushes students into a different way of being in a class. Many of them have been taught that all their learning must be individual; working with partners in a class is tantamount to cheating. As Helen Place comments,

> You have to train your students to do this; they don't come by it naturally. You have to be patient. Students do not collaborate naturally. They have been taught to compete, and not work together. . . . When I explain what I am doing with the class, I make an analogy to any sport. I tell the class that I can solve these chemistry problems and they can't—yet. The only way they can learn to do it is to do it for themselves. I say to them, "I am making you practice, just like practicing for football." This is directed, coaching practice,

> which, after a while, leads to competence. . . . It usually takes me about half the semester before students really get into the rhythm of working problems with their neighbors in class. Those that go on to the second-semester chemistry classes are all ready to go, of course [personal interview with the authors, Sept. 1998].

References

Angelo, T. A., and Cross, K. P. *Classroom Assessment Techniques: A Handbook for College Teachers* (2nd ed.). San Francisco: Jossey-Bass, 1993.

Chickering, A. W., and Gamson, A. F. *Seven Principles for Good Practice in Undergraduate Education.* Racine, Wis.: Johnson Foundation/Wingspread, 1987.

Johnston, S., and Cooper, J. "Quick-thinks: Active-thinking Tasks in Lecture Classes and Televised Instruction." *Cooperative Learning and College Teaching,* 1997, *8*(1), 2–7.

Kagan, S. *Cooperative Learning.* San Juan Capistrano, Calif.: Resources for Teachers, 1994.

Lyman, F. "The Responsive Class Discussion." In A. S. Anderson (ed.), *Mainstreaming Digest.* College Park: College of Education, University of Maryland, 1981.

Mazur, E. *Peer Instruction: A User's Manual.* Englewood Cliffs, N.J.: Prentice Hall, 1997.

O'Donnell, A. M. "Facilitating Scripted Cooperation Through the Use of Knowledge Maps." *Cooperative Learning and College Teaching,* 1994, *4*(2), 7–10.

O'Donnell, A. M., and Dansereau, D. F. "Scripted Cooperation in Student Dyads: A Method for Analyzing and Enhancing Academic Learning and Performance." In R. Hertz-Lazarowitz and N. Miller (eds.), *The Theoretical Anatomy of Group Learning.* Cambridge: Cambridge University Press, 1992.

Walberg, H. "Improving the Productivity of America's Schools." *Educational Leadership,* 1984, *41*(8), 19–27.

Wilson, R. C. "Improving Faculty Teaching: Effective Use of Student Evaluations and Consultants." *Journal of Higher Education,* 1986, *57*(2), 192–211.