Strategies to increase active discussion and thinking for *all* students

How many times have you expected to hold an exciting class discussion after a laboratory activity or demonstration only to have just one or two students speak? Or, how many times have you introduced a controversial issue for class discussion only to be met with blank stares or indifferent responses? Unfortunately, engaging middle level students in meaningful, thoughtful discussion is an ongoing challenge for teachers.

I would like to share three strategies that I have used to increase student participation in class discussions. These can be easily applied to any science content area and have proven to be effective in stimulating student participation by allowing students to communicate their ideas and consider alternative explanations using nontraditional classroom arrangements. Aligned with the National Science Education Standards and grounded in active learning, cooperative learning, and contemporary learning theories (Bruner, Goodnow, and Austin 1986; Egan 1994; Gardner 1999; Gibbs 1995; Johnson and Johnson 1994; Kagan 1994; Vygotsky 1978), these three instructional discussion formats increase student participation, promote interpersonal regard, and heighten classroom community and reflective thinking during discussions. They offer *every* student active learning strategies that facilitate dialogue, exchange ideas, encourage community building, and increase the physical movement in your classroom (NRC 1996).

Concentric circles

This format involves students forming two concentric circles, one facing inward, and the other facing outward (Figure 1). Both circles may contain a group of six or more students. The inner circle remains stationary while the outer circle rotates. The circles may be formed using chairs or simply having students stand in circular formation. This structure may be used during hypothesis-seeking activities, while reviewing homework/laboratory questions, when generating experimental procedures, or when exchanging ideas on controversial issues (Pike and Selby 1988).

Possible application scenarios

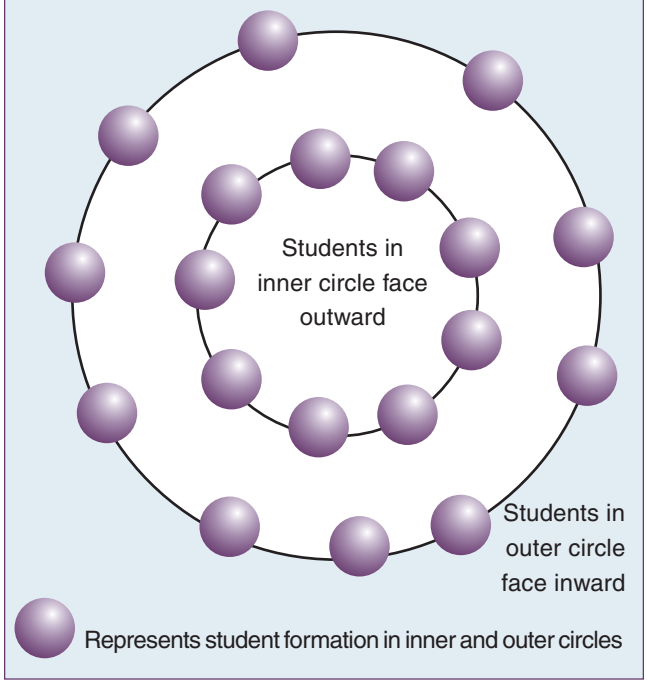
Scenario 1: Pose a problem/question on the board and ask students to think about how they could solve the question. Allow students some time (20 to 60 seconds). Now announce: "The inner circle person will tell the person on the outside how you would attempt to solve the question. When you are finished sharing, say 'pass,' and have the outside person share or extend the thinking of the inside person." When completed, have the outside people rotate one to the left or right. The new partners can share their ideas for the problem one more time with a new person or consider a new question that you pose.

Scenario 2: Students are becoming a bit restless on a Friday afternoon as you complete a short lecture presentation. Put your class in concentric circles and have them respond to questions relating to the content that you have been studying. Allow students some time to think of responses before asking them to share. Have the students rotate after each question.

Variations and considerations

For large classes, it may be advantageous to form two or three concentric circles that function simultaneously. Alternatively, students can travel in pairs (acting as one student) on the outside circle as they rotate, interacting with students in the inner circle. Pairing is also helpful in cases where you have an odd number of students, second language learners, or special needs students that can be combined with stronger students.

FIGURE 1 **Concentric-circle arrangement**



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Remember to allow sufficient wait time for student thinking prior to sharing, and use levels of questioning that are not too complex and can be answered within one to three minutes.

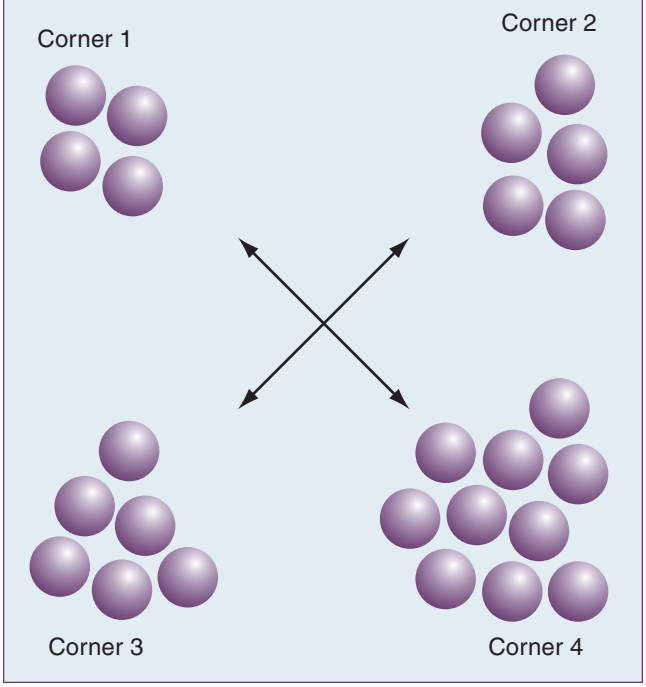
Four corners

After posing a statement, issue, or question, have students choose a position and move to a corner of the classroom that best captures their perspective, view, or response. In the corner, students share their reasons for taking their respective positions (Figure 2). This format encourages students to function at more creative and evaluative levels of thinking and can be especially helpful in prompting students to engage in further debate. In addition, this tactic allows you to conduct a quick assessment of your students' thinking on an issue (Bennett and Rolheiser 2001).

Possible application scenarios

Scenario 1: Select an issue and begin with a provocative opening question or statement. For example, "Students with AIDS should be allowed in our school." Set up posters in each corner of your classroom with: "Strongly Agree," "Agree," "Strongly Disagree," or "Disagree." Give the students some time (30 seconds) to make their decisions without discussion and have them move to the area of the room that best represents their stance. Tell the students to share and explain their reasons for choosing the position with other group members in the corner. Following this, you randomly call on pairs of students to summarize reasons for taking the stance.

FIGURE 2 **Four corners arrangement**



Scenario 2: During a demonstration on static electricity, you blow up two balloons attached to strings. Ask students to make predictions as to what will happen when you rub both balloons against your hair. Students independently decide on their predictions and move to one of the places in the classroom labeled: "Balloons will push away from each other," "Balloons will stick together," "Balloons will do nothing," "Balloons will pop," and "I don't know." Students move to their respective choices and share their predictions and explanations with their group members. Have the group spokesperson share their preconceived ideas with class before the demonstration. Conduct the demonstration and have students explain their observations and relate them to their predictions.

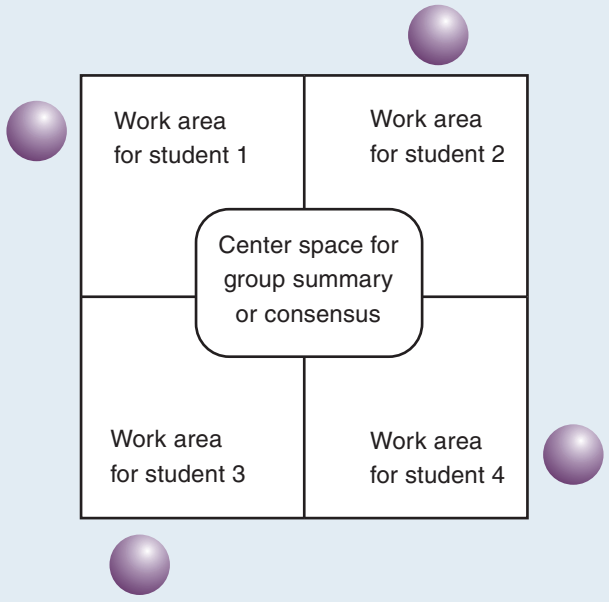
Variations and considerations

- You may have three, five, or even six corners or places (clearly labeled in the classroom) for students to move or choose, based on their thinking or attitudes toward an issue.
- Another variation in using this format may be to assign students to a position and have them think of reasons to support the position.
- Allow students enough time to think and encourage them to be independent thinkers rather than simply following or being influenced by their friends. If students are being swayed by their friends, you may have the students quickly write their positions and rationale on index cards before they move and take their cards to their respective corners.
- Once the students are in larger groups in the corner, have the students discuss their ideas in groups of two or three. Ensure that students are paired up before they begin sharing. This will emphasize the importance of individual accountability and set the norm for future sessions.

Place mat

This structure promotes both individual and group thinking and reflection on issues, questions, or solving problems. Acting as the "place mat," a piece of chart paper is divided up into pieces based on the number of group members, with a circle or square located centrally (Figure 3). Group members individually consider the question posed and jot their thoughts in their own space before sharing their ideas with other group members (ranging from three to six). Following this, students exchange their ideas and produce their group summary or consensus, which is then recorded on the centrally-located place mat (Bennett and Rolheiser 2001).

FIGURE 3 **Place mat arrangement**



Possible application scenarios

Scenario 1: You have illustrated how to convert units of length using the metric system (e.g., How many centimeters would be in 2 meters?). You would like the students to work out the solution to another example. You ask the students to write their answers in their own space on the place mat and then share their thinking with others in the group. The group shares their thinking and comes to a consensus and places their final answer in the central area of the place mat. (Another example may include having students classify various substances into states of matter.)

Scenario 2: In an attempt to come to a consensus about an issue (e.g., What were the key variables affecting the outcome of their experiment?), each person individually writes their ideas about the most important issue in their respective space on the place mat. Following this, students circle two or three central ideas and place a star by the most important idea considered. Group members then share their ideas by reading from their individual list and sharing their explanations. The starred items, representing the key ideas, are written in the middle of the box. By the end of this process, each group member has contributed key ideas to the middle box and these may be shared with the rest of the class.

Variations and considerations

- You may choose to have groups of three, four, five, or six. Although using regular 8½ × 11 inch paper may also work for this format, using chart paper would make the event more enjoyable and the work more legible. Markers can also be used.
- You can use this structure for brainstorming or for generating preconceived ideas during new units/topics or note-taking during videos/demonstrations or summaries of key ideas. Not only does this emphasize respecting individual ideas, it also emphasizes active listening and critical thinking.

General considerations

Problem behaviors during group collaboration have been one major concern voiced by some teachers attempting to implement these structures in their classrooms. Often, they fear that some members may adopt behavior that may obstruct the functioning of the group. Some ways to ensure group collaboration include:

- The teacher facilitating the process by encouraging students to acknowledge problems as "group problems" rather than individual problems. Conduct discussions about expected roles and behavior.
- The teacher modeling or simulating desired language or group behavior.
- Rewarding positive interdependence and individual accountability. Both of these rewards can be gradually increased as students become more skilled at the collaborative process and have an increasing investment in the group's success. For instance, establish a goal for "minimum" group performance. If every member of the group achieves the minimum standard of performance, each member receives a pre-determined bonus score.
- Allowing students to rate their group members' performances and/or their own contributions during the discussions.
- If you are a novice in using collaborative discussions in your classroom, I recommend that you introduce cooperative group tactics gradually by first reading and trying some activities suggested in references listed at the end of this article.

Conclusion

In using these three instructional discussion structures intermittently throughout my science teaching, I have found that *all* students, whether English-language learners, those with attention deficit disorder, or accelerated learners, develop into a community of learners that model the openness of exchanging ideas and data that epitomize science. Over time, they eagerly voice and debate their scientific ideas and come to accept and share responsibility for their own learning. They begin to reflect

on their own thinking and become aware of their own understanding for making decisions or strategies for solving problems. In the end, students not only develop deeper levels of thinking and listening skills, but also appreciate the perspectives of others.

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For further reading

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Weathering database technology

Collecting weather data is a traditional part of a meteorology unit at the middle level. However, making connections between the data and weather conditions can be a challenge. One way to make these connections clearer is to enter the data into a database. This allows students to quickly compare different fields of data and recognize which readings are associated with certain types of weather.

To get started, you'll need to set up a simple weather station outside in a secure area for gathering data. I suggest that it include a thermometer, rain gauge, anemometer, barometer, wind vane, cloud identification chart, and relative humidity sensor. (If you do not have a relative humidity sensor, visit *http://ianrpubs.unl.edu/generalag/g626.htm* for two simple methods for determining relative humidity using two thermometers). A good location may be outside your classroom, where you can monitor the students. Other common locations such as the main entrance may work, but reduce your ability to monitor it and increase the likelihood of other students in the building possibly damaging it. The weather stations are rather inexpensive to make (with the exception of the hygrometer and barometer, approximately $20 each), so if it is damaged, new wind vanes, precipitation gauges, and so on can often be purchased at local stores. If you order the equipment through a science catalog, items can be reordered promptly if needed, or you may want to consider having an extra set of station materials on hand.

Introduce the weather data chart (Figure 1) and how to collect the information to the students prior to any weather instruction. This will require you to dedicate a class period to instruction on the procedures the students will use to collect the information. It may also take a few guided class trips to the station, but once students catch on, they can independently gather the information at any convenient time during the school day. For example, students could collect their data when arriving at school, right after lunch, or at the end of the day before dismissal. Allowing students to work around their schedules means smaller groups at the station at one time, and does not take time away from the science class period. The goal is to have all students actively collecting their own data.

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Putting the collected data to use

Generally, a unit on weather will last several weeks. Plan for at least a month of weather data in order for the students to

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