Tips for Creating Effective Class Discussions

Class discussion is one way teachers can determine how students are processing information in the short stories. Students possess many misconceptions regarding the nature of science (NOS) and these are sometimes so tightly held that they can cause some students to misinterpret the stories and draw mistaken conclusions. Class discussion is an effective way to draw out those mistaken interpretations and help students develop more accurate views about science content and how science is done.

The following are research-based teaching behaviors and strategies for promoting discussion in classes. At first some of these behaviors and strategies may seem awkward and success may not be immediate. Effectively promoting discussions is complex and requires several teaching skills to be present simultaneously. However, with practice you will achieve success and these behaviors and strategies will become quite natural.

1. Use an open-ended question to frame the discussion. If your question can be answered with just a few words, or yes/no, rephrase it so that it requires extended responses. Here are some possible question stems to help.

a. What are the impacts of….?
b. What are some ways to….?
c. How does _____ compare to _____?
d. If _____, what might you expect to happen?
e. How does _____ reflect what you know about _____?

The embedded questions in the short stories are all examples of open-ended questions. They may be used to provide a starting point for class discussions, but do be prepared to hear answers that convey misinterpretations of the stories and misconceptions regarding science content and the NOS.

2. Wait at least four seconds for students to respond after you have asked a question. Waiting for students to process a question, think, and then answer seems obvious. However, research indicates that teachers generally wait only one second before answering their own question or rephrasing it as a less-demanding question so the answer is fairly obvious. College students are often used to lecture and may be genuinely surprised when attempts are made to involve them in discussions. Be prepared for students to stare back, waiting for you to move on. Wait expectantly (eyebrows raised, arms out with palms up, posture upright and slightly forward, and look eagerly at students). If you have a class that is particularly reluctant to talk, *frame the task in advance*. For example, provide students the question and have them turn to their neighbor and discuss this question. Tell them they have 30 seconds (You may always provide more time if needed.) to come to a reasonable answer. Walk around and listen to what students say. Then either ask students to share their answer or call on students randomly to share what their group talked about. Having discussed the question with a peer, students now have something to share about the question.

3. Refrain from judging students' responses. If you want students to share their thoughts and ideas, avoid immediately assessing a student's response as right or wrong. Instead, acknowledge their ideas (whether they are correct or incorrect) and work to get ideas from other groups in the following ways:

a. Okay, what are some ideas that emerged in other groups?
b. What else?
c. Alright. Let's hear from another group!
d. Tell me more about that.

This encourages multiple groups or students to put ideas forward. While tempting, don't stop the discussion when you receive the right answer. This is important to elicit students' misconceptions that would have otherwise gone undetected. Having students leave with an accurate view of the science content and the NOS in the stories is crucial, but to achieve this you first need to find out how students are piecing things together. An effective way to acknowledge students' ideas is to write them on the board. Some instructors have students write on chart paper or on small whiteboards and then post these on the wall or lean them up on the chalk tray. These strategies provide you a list of students' ideas to use as you work to help them come to an accurate view of the science content and the NOS. Acknowledging students' ideas rather than immediately judging them makes more likely that you will understand students' thinking.

4. Once students' ideas have been exhausted, ask another question or build on students' responses to the previous question. Having listed students' previous ideas can come in very handy. Here's a scenario:

Assume students were discussing Question One from the geology short story *Continents: A Jigsaw Puzzle with no Mechanism*. The question is: "Note how several of these explanations use catastrophes appearing in religious texts to explain natural events. How does this illustrate the influence of the wider culture and prevailing ideas on people investigating the natural world?" As students provide their ideas, you might notice that many students think that scientists were religious in previous centuries, but now they have "moved forward" and abandoned religion. You want to address this simplistic idea and get students to think about how scientists may hold religious beliefs in their personal lives, but use naturalistic explanations when doing science. You might say something like the following:

> "Okay, so we came up with seven different possible ways that the wider culture and prevailing ideas can influence an individual scientist. I want to help us narrow this list a bit, so here's something I want you to discuss. To what extent you think scientists today can hold religious views?"

After discussion, students will likely have examples of scientists who hold religious beliefs. If not, you may provide several examples. Students may be confused about how this can be when to them science appears atheistic. Now you can introduce the concept you want them to think about.

> "So scientists may hold religious views even though when doing science they work to explain natural phenomena without reference to a supernatural being or event. Here's a scenario to think about. Assume you go to the auto mechanic and the mechanic tells you that the noise in the engine is due to a supernatural being. Even though you may strongly believe in a supernatural being, why would you likely find that explanation unsatisfactory? Why don't we accept the supernatural explanation in this context, even though we can't rule it out? How is this auto mechanic example like science? (After each of these questions be sure to wait in order to receive multiple responses!) Notice that in science, we can't rule out supernatural explanations, but we can't use them either. We are limited when we do science to explaining things with natural explanations. So, in their personal lives, scientists may or may not be religious, but when they do science they seek naturalistic explanations for natural phenomena. Now, let's go back to our list and make some refinements. What might we change in our original list?"

• See *Modeling Effective Teaching Techniques* for a short video clip illustrating how to promote discussion in a small or large class setting.
• If you teach large classes, read *Additional Strategies for Promoting Discussion in Large Class Settings*

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Partial support for this work was provided by the National Science Foundation's Course, Curriculum, and Laboratory Improvement (CCLI) program under Award No. 0618446. Project Principal Investigator: Michael P. Clough. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.