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Part 2

Exploring Discussion in Your Classroom

What Is Discussion?

Among the terms dialogue, discussion and debate, you are probably most familiar with the term discussion. Your lesson plans may already include sections for various forms of discussion, either in small groups or with the whole class.

Research has shown that when you ask students questions as part of a discussion, it can sometimes turn into a guessing game of sorts. Students compete for the prize of your approval by trying to come up with the answer you are thinking of (Sandoval, Deneroff and Franke, 2002). While your goal may be to encourage students' inquiry, such discourse might actually have the opposite effect (Sandoval et al., 1999).

While this kind of discussion may help you assess how well your students understand a topic, students learn more when they have the opportunity to co-construct ideas. If discussions consist of you asking questions and seeking specific answers, then your students may see you as the expert and try to match your thinking instead of coming up with their own ideas. Instead, you can revoice a student's statement, which encourages other students to respond. Students will be able to explore their thinking instead of just recalling facts. This simple shift still allows you to meet instructional goals by influencing the direction of the conversation and stressing the importance of co-constructing knowledge (Mehan, 1979; O'Connor and Michaels, 1996; Jurow and Creighton, 2005).

When students go from trying to find your predetermined "correct" response to constructing their own concepts, the discussion is elevated to a whole new level. You may find that your students move from the *Remembering* level in Bloom's revised taxonomy of cognitive thinking to the other three levels of thinking—Applying, Analysing and Creating. Hopefully, your students will begin to apply the information they have read or observed to new contexts—finding patterns, organising ideas and combining knowledge from several areas.

How Do I Prepare Students for a Discussion?

Discussion works best when your classroom is a place where students are able to explore their thinking openly. Students shouldn't worry about being corrected by you or other students. If probing for understanding does not come naturally to your students, you may need to coach them. Explain that paraphrasing and questioning encourages discussion. Developing these skills in your students will also help in later use of dialogue techniques.

Unlike dialogue, which also works towards common understanding, discussion does not presume there are two opposing ideas to be explored. It is best to use discussion when students are grappling with new ideas or observations. Unlike dialogue and

Discussion: Nanotechnology

TEACHER PAGE

What Is Nanotechnology?

Nanotechnology is applying techniques at the molecular-scale to create new materials. It is broader and has existed longer than is generally recognised. All genetic engineering is considered nanotechnology, as well as colour-changing bioindicators such as pregnancy tests, and material coatings such as Teflon. Applications of nanotechnology include manipulating molecules to create stronger steel, water-repellent clothes, or better-targeted drugs. Alongside the promised benefits of these new technologies are the fears that they can also bring about unintended dangerous effects. Examples include the possible creation of mutated viruses that can self-replicate, or in a broader setting, nano-machines that can recreate themselves, doing harm as well as good.

Is This a Discussion, a Dialogue or a Debate Topic?

This topic is best formatted as a discussion. It is in the news often, yet is it not well understood. You could use debate or dialogue formats as well, since opinions are strong on opposite sides of this topic. (See extension or model debate on genetic engineering in food.) However, a general survey of nanotechnology is helpful prior to having students investigate one aspect. A discussion will allow students to clarify their understanding and explore a wider range of the science.

TIME Preparation: 15 minutes in class, plus homework
Instruction: two 45-minute class periods



Investigation Question

What types of nanotechnology should the government fund?

Classroom Format

Begin by having students examine some media reports on the value of nanotechnology. Have them identify the authors' conclusions, key points and supporting evidence. In class, have them discuss their articles, drawing conclusions from all of them about the value of nanotechnology. As an extension, have students review the materials to determine if there are any fallacies presented in the reasoning.

If your students have not used news media reports in the classroom before, it is best to have them do this for a few weeks before this discussion. A simple format is to have each student select one news article about a science topic relevant to the course. Have them write a summary that includes the author's conclusion and three to four key points. Also have them identify any errors in presentation of science concepts, using their Student Summary: Discussion section. This will help them spot any fallacies in the author's arguments. Articles should be brought to class and made available for other students to read. As students arrive for class, have them get into groups of three to share their articles. As a whole class, students can give a few key points from the articles.

Preparation (during prior class)

1. Distribute the student pages and the Student Summary: Discussion section.
2. For homework, ask students to find and read a news article on nanotechnology. (Do not discuss what nanotechnology is; have students find out for themselves.) Allow them to select one of four nanotechnology areas to research: biology, chemistry, physics or technology. There may be some overlap, which is fine. Groups should be roughly the same size. (5 minutes)
3. As homework, have your students write a summary report on their article. The summary should do the following:
 - define nanotechnology
 - identify the author's conclusions and key points, including any opinion that is expressed
 - identify any evidence the author uses to support points
 - note any science content or reasoning errors
4. Have each student also create a headline (a statement three to eight words long) for his or her summary that points out the type of research involved. Examples include the following: Scientist Creates New Material to Rainproof Pants; Genetic Marker for Alzheimer's Disease Found; Nano-Drug Attacks Only Cancer Cells; Computer Chip Made for Use in Human Cells; New Solar Cell Uses Photosynthetic Processor. (5 minutes)
5. Describe the procedure that will occur in the next class. (5 minutes)

Discussion: Nanotechnology

Nanotechnology is a blend of science and technology. It is based on the ability to create new products by moving atoms and molecules individually. Research is being conducted into creating new medicines, new building materials, new fabrics, improved solar energy equipment and new organisms that can clean up environmental problems.

Investigation Question

What types of nanotechnology research should the Government fund?

Assignment

1. Select one of four areas to research in nanotechnology: biology, chemistry, physics or technology.
2. Find an article on that type of nanotechnology in a current newspaper, in a magazine or on the Internet. Be sure to analyse websites to confirm that the information is reliable. (See the websites on evaluating web pages, located in the Resources section.)
3. Write a summary report on the article. The summary should include the following:
 - a definition of nanotechnology
 - the authors' conclusions and key points, including any positive or negative opinions on nanotechnology presented
 - identification of any science content errors
4. Create a headline (a statement that is three to eight words long) that summarises the story and points out the type of research involved. Examples include the following: Scientist Creates New Material to Rainproof Pants; Genetic Marker for Alzheimer's Disease Found; Newly Developed Nano-Drug Attacks Only Cancer Cells; Computer Chip Made for Use in Human Cells; New Solar Cell Uses Photosynthetic Processor.
5. Bring your article and summary to class. Be prepared to share your summary with classmates.