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ECO 101

Note: Charlene D'Avanzo is the editor of **Ecology 101**. Anyone wishing to contribute articles or reviews to this section should contact her at the School of Natural Sciences, Hampshire College, 893 West Street, Amherst, MA 01002. E-mail: cdavanzo@hampshire.edu

Using Discussion to Promote Learning in Undergraduate Biology

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Summary and Comments from Workshop 40: “Looks Who’s Talking! Using Discussion as an Effective Learning Tool” presented at the 100th Ecological Society of America Meeting

In-class discussions can help students explore, develop, synthesize, and evaluate scientific ideas. At the same time, discussion can provide an opportunity for instructors to formatively assess student understanding and learning. In-class discussion can foster the ability to communicate and collaborate, identified by the Vision and Change in Biology process as a core competency expected of undergraduate biology majors (Brewer and Smith 2011). However, leading an effective discussion is often challenging for both faculty and students. Even very experienced educators can struggle to foster productive student discussions and may be intimidated by the idea of “losing control” of the classroom by allowing student discussions to occur.

Students can also lead effective classroom discussions; however, many of them may never have been given any instruction on how to do so. To address these challenges of using discussion as a learning tool, we explored the many ways in which discussion can be structured to make it easier to lead. Facilitators can use techniques such as the three we demonstrated (see the section on “Cases studies” below for examples of rotation stations, chalk talks, and snowballing) to help facilitate discussions, and there are

many more structured ideas including circular response, or hatful of quotes (see Brookfield and Preskill 2005, and the end of this article for more suggestions).

We developed this workshop as a way to investigate effective methods to implement discussion and ultimately, feel more comfortable using this technique in our own classes. Thus, the overall goal of this workshop was for participants to explore a variety of techniques to facilitate the use of discussion in their classrooms across undergraduate levels, including nonmajors courses, and to improve student learning, particularly critical thinking skills and communication. Our three specific goals included: (1) as an instructor, how to prepare to lead a discussion, (2) how to prepare students in your class to effectively participate in discussion, and (3) how to help prepare students in your class to lead discussion. Here, we present a combination of the ideas from the teaching literature as well as additional ideas we learned from participants in our workshop.

The scope of the workshop was limited to discussion, which we distinguish as fundamentally different from conversation. We defined discussion as a structured interaction that used evidence to support claims. Conversations are more about what we think and feel and less about evidence, claims, and justifications. For more details on the distinction between conversation and discussion see Brookfield and Preskill (2005).



Participants discuss in pairs before sharing in larger groups of four, as part of the “Snowballing” activity at the workshop.

Why use discussion and how to help discussion be successful?

We focused initially on why to use discussion to promote learning and, by extension, how to make discussion a more successful teaching tool. We used a discussion technique of “rotation stations” (Brookfield and Preskill 2005) to elicit participant ideas about the why and how of in-class discussions. Participants rotated through four discussion stations, answering a different discussion question at each station.

Station 1: what learning goals can be achieved with discussion?

Prior to the workshop, we used published literature (e.g., Brookfield and Preskill 2005) to identify a few learning goals that could be supported by discussion. We augmented this list with ideas from work-

shop participants. Discussion can help students: (1) learn to develop and support a position and “think like a scientist”, (2) gain exposure to diverse viewpoints, become more respectful of academic disagreement, and to become more confident about taking intellectual risks while also potentially learning how to be wrong gracefully, (3) improve students’ ability to listen and to self-critique, and (4) develop a collective, informed, critical understanding about a topic and to distinguish facts from opinions and values.

Station 2: what are some ground rules that are necessary to help a discussion succeed?

It is essential to establish ground rules for class discussions that foster inclusiveness, reflection, and respect. Including students in the generation of these ground rules allows students to feel some ownership over the discussion and feel that it will be a “safe” environment in which to participate. Some of the ground rules that workshop participants brainstormed included: (1) one person speaks at a time and is not interrupted, (2) no name calling; respect all participants, (3) respect the time limit for speaking (suggest no more than 2 min per speaker) so others can talk, (4) make sure everyone gets a chance to participate, and (5) listen closely to what others have to say.

There were several other suggestions that might help students understand the structure of discussion. For example, assigning roles, such as a moderator or facilitator can be beneficial. Students can also be given the discussion question(s) ahead of time so that they can prepare for the discussion. Finally, the instructor or a student should do a wrap up of the discussion at the end to summarize and synthesize main points.

Station 3: how can instructors engage skeptical students?

It can be challenging to engage some students in discussion for various reasons. Participants brainstormed several ideas for engaging those reluctant students. Many give participation grades so that the discussion counts toward the grade; this is meant to incentivize participation. Praising participation, rather than “correct” answers, can also be beneficial. Again, as part of developing ground rules, participants need to know their views will be respected and not dismissed or ignored.

A second suggestion from participants was to scaffold discussions. For example, in the first discussion(s) of a semester, the instructor should facilitate and model what that role looks like; later in the semester, students can take charge of leading and facilitating discussion. Online discussion boards and/or icebreakers help students become comfortable with a new topic and with discussion as a form of teaching. Instructors could also use spontaneous rewards (like candy) for participation.

A final component of any discussion is feedback. Students should reflect on the discussion to identify key ideas worth exploring further, to articulate questions they still have, and to more generally understand the purpose of a discussion for generating and synthesizing ideas.

Station 4: what physical aspects of a discussion (such as space logistics, group size, etc.) can we control to improve discussion?

We realized there are physical aspects of classroom set up and group design that can help make discussions more successful. Some of the ideas brainstormed included the importance of: (1) comfortable chairs, smaller group sizes, rooms with plenty of windows and light, (2) the potential benefits of providing food to keep energy levels up, (3) asking students to turn off phones and computers during dis-

discussion, (4) providing a white board or similar to record main discussion points, and (5) possibly using some form of randomization for calling on students to ensure broad participation.

More details of the brainstorming sessions are available at our workshop website.¹

How can faculty do a better job of leading discussion?

Faculty often does not have any training in the facilitation skills that are needed to help lead a successful discussion. A good facilitator will prompt a discussion to keep it going at moments when it may appear to be slowing down or getting off track. There are a suite of question types that can be used to achieve many goals such as: (1) questions to ask for more information or evidence or clarification, (2) questions to extend discussion and link to other previous topics, (3) summary or synthesis questions, or (4) questions to open up more possibilities (open-ended questions). We provided examples of these questions in Table 1 which we culled from Brookfield and Preskill (2005) and from Nash et al. (2008).

Another challenge faculty face when preparing to lead discussion is that they under-prepare which can result in a lackluster or ineffective discussion. We focused the next workshop activity specifically on helping instructors do a better job of preparing to lead a discussion. In this activity, termed “Chalk Talk” (Brookfield 2011), we asked participants to reflect on following question, “How do you, as an instructor, prepare to lead a discussion? (what are the kinds of things you might do to prepare to lead a discussion?)”. When ready, participants would silently add their ideas to a giant sticky note in the center of their group.

Some of the suggestions participants generated to help instructors prepare included: (1) identify some goals or desired outcomes for the discussion, (2) read the reading carefully and/or do any other pre-research preparation ahead of class, (3) write out some questions to get the discussion started, to keep it going, and/or to redirect if necessary (See Table 1), (4) consider using additional graphics or figures to stimulate or enhance the discussion, (5) think about group composition, group size, etc. ahead of time, (6) select a strategy for how small groups will report out to the larger group as needed, (7) be ready to call on students if necessary to get more participation, (8) think about links between the discussion topic and materials covered previously in class to help students make connections to the bigger picture, (9) consider anticipating student responses and being ready to deal with different types of responses while being supportive of participation in discussion whether the answer is “correct” or not, and (10) consider how to wrap up the discussion and what main points you hope to be able to highlight at the end.

How can faculty help students prepare for a discussion?

The suggestions for how to help students prepare for discussion were split between directly preparing for the activity itself and building some skills in advance of the activity. Before the activity, it is important to set up an active classroom where students become comfortable with speaking in class. Posing broad, reflective questions at the beginning or end of class can get students used to responding to more open-ended questions. It is also helpful to get students and instructors used to brief periods of silence—sometimes good discussion requires a moment of reflection first. In lecture, instructors can pose a question and count to fifteen before seeking student answers. In addition, instructors should help students learn to listen and not just hear. Activities that explicitly require students to share another’s perspective can also foster better listening skills.

Table 1. Questions to keep a discussion going.

<p>Questions that ask for more evidence</p> <p>How do you know that?</p> <p>What data is that claim based on?</p> <p>What does the author say that supports your argument?</p> <p>Where did you find that view expressed in the text?</p> <p>What evidence would you give to someone who doubted your interpretation?</p>
<p>Questions that ask for clarification</p> <p>Can you put that another way?</p> <p>What's a good example of what you are talking about?</p> <p>What do you mean by that?</p> <p>Can you explain the term you just used?</p> <p>Can you give a different illustration of your point?</p>
<p>Linking or Extension Questions</p> <p>Is there a connection between what you just said and what was said a moment ago?</p> <p>How does your comment fit in with someone else's earlier observation?</p> <p>How does your observation relate to what the group decided last week?</p> <p>Does your idea challenge or support what we seem to be saying?</p> <p>How does that contribution add to what has already been said?</p>
<p>Summary and Synthesis Questions</p> <p>What are one or two particularly important ideas that emerged from this discussion?</p> <p>What remains unresolved or contentious about this topic?</p> <p>What do you understand better as a result of today's discussion?</p> <p>Based on our discussion today, what do we need to talk about next time if we're to understand this issue better?</p> <p>What key word or concept best captures the gist of our discussion today?</p>
<p>Questioning to Open Up Possibilities</p> <p>(Note: Open-ended questions, especially those beginning with why and how, are more likely to provoke students' thinking and problem-solving abilities and make the fullest use of a discussion's potential for expanding intellectual and emotional horizons.)</p> <p>How can we think about this in another way?</p> <p>Why do we continue to use this particular process?</p> <p>How might this idea open up new possibilities for us?</p> <p>What are the options available to us in solving this problem?</p> <p>What are the advantages of viewing the situation this way? What are the disadvantages?</p> <p>Why do you think many people devote their lives to education despite the often low pay and poor working conditions?</p> <p>Let's completely revamp this program. How might we go about it?</p>

Participants again echoed the idea that prior to the actual discussion, it is essential to work with students to set ground rules (see above); this can be done as an informal discussion. Some faculties have found that it is helpful to discuss with the students what experiences they have had with good and bad discussions to identify good discussion habits. Short video clips could also be used to illustrate this. Faculty members could consider bringing in a colleague beforehand and modeling how to discuss about a scientific topic.

Although most of the workshop was focused on in-class discussion, online discussion boards, which have different challenges, are also being used more frequently. Many participants who use online discussions require participation in the form of both posts and replies and suggested that online discussion can be another way to help students prepare for in-class discussion topics.

For the discussion itself, it is critical to select a topic that is worthy of a discussion: complex, controversial, or rich enough in nature and appropriate to the level of the class. Many discussions are focused around having students read a journal article or some other written material. Especially in the beginning, it works best to provide some scaffolding for students while they read. These might involve providing a series of questions or teaching a more general approach to reading where students look for points to discuss while reading. Some have students write “surprise statements” where students have to turn in written short papers with one paragraph summarizing the paper and one paragraph about what surprised, confused or struck them most about the paper. Students might need some help identifying suitable supporting material, if they have difficulty with the reading for discussion.

How can faculty help students prepare to lead an effective discussion?

Students can lead effective classroom discussions, but many have no instruction on how to do so. Workshop participants suggested that students who are assigned to lead a discussion may find a one-on-one discussion with the instructor useful. Such a meeting can be an opportunity to alleviate fears, to make sure students understand the material, and to ensure students have good questions that will prompt and facilitate the discussion. Students could also give a mini-lecture on the topic before starting discussion. It is important to recognize that if students are going to lead a discussion, mistakes will be part of the learning process. Instructors must be ready to let students make some mistakes as they learn.

Good facilitation involves injecting the discussion with new questions when the conversation lags or gets off track. It may be helpful to share with students the questions in Table 1 to help them understand the different kinds of questions they can use to facilitate a discussion. Even so, students may have very little experience gauging how a discussion going. Therefore, instructors should be ready to call on the discussion leaders to clarify an idea, reframe a question, or move on to the next question, if necessary.

Case studies of discussion techniques that we used in our workshop

During the workshop, we modeled three different techniques to help instructors lead a “structured” discussion. We received a lot of positive feedback from participants that getting to actually participate in these different techniques during the workshop was really helpful as both a way for them to learn the technique but also as a way to help them determine how they could potentially use the different activities in their own classes. Here are descriptions of the three techniques we used.

Rotation station

The first technique is called “Rotation Stations” (Brookfield 2011) in which students begin at one station and brainstorm answers to a question. This may work best with a flip chart or blackboard space for students to see the question and contribute answers. Then they rotate through additional stations that have different questions, adding to the previous groups’ answers. We had the last group to reach each rotation station do a report out of the main points of all previous groups plus their own to the full group at the end in a big class discussion so that everyone could see all the ideas generated at each station.

Chalk talk

This activity began with a giant sticky note placed in the center of a group and everyone has a pen. A question is on the paper and everyone works silently thinking and writing answers for several minutes. Then the group discusses each person’s response. If time permits, a larger group discussion can occur with a report out from each smaller group. This technique is meant to especially help students who are shy about speaking in front of others and the workshop participants agreed that they thought this technique could be a useful way to involve quieter students in discussions in their own classes.

Snowballing

In this activity, individuals are paired off and were asked to first think about an answer to a question (in the workshop the question was “What do you do as an instructor to help students be prepared to participate in discussion?”). Each person was to think about this and then discuss with their partner. Then two pairs of partners got together and shared their ideas. Finally two sets of four got together into a group of eight to discuss (think, pair, pair of pairs, group of eight), and then finish with full group discussion. We concluded with a large group discussion in which we asked people to share the most creative ideas they had heard or discussed. During the snowball, it was noticeable that the volume started quite loud but quieted down as the discussion groups became larger. Workshop participants felt that this was an interesting technique but going much beyond a group of eight would probably feel repetitive to the class and some felt that going all the way to groups of eight led to discussions that were too repetitive without enough new ideas being generated. So, perhaps snowballing and only going to groups of four is a way of modifying this exercise to make it less time-intensive and more useful.

Other useful techniques

There are many other techniques discussed in the literature. See below for some additional ideas we did not try in our workshop.

Stephen Brookfield, See: http://www.stephenbrookfield.com/Dr._Stephen_D._Brookfield/Workshop_Materials_files/Discussion_as_a_Way_of_Teaching_Packet.pdf

Circle of voices

Hatful of quotes

Circular response

*Snowballing

Newsprint dialog

*Chalk talk

*Rotating stations

Newsprint dialog

Drs. Cavanaugh, see: http://drscavanaugh.org/discussion/inclass/discussion_formats.htm

Critical debate

Three-step interview

Jigsaw

Generating truth statements

Posted dialogue

Learn NC, see: <http://www.learnnc.org/lp/editions/altdiscuss/?ref=search>

The talk show

PR campaign

History and literature on trial.

Conclusions

There are many ways to structure classroom discussion, from completely open to more controlled. Underlying all in-class discussions is student learning: how will discussion foster student learning of content, skills, and self-reflection. By articulating clear discussion goals, instructors can then identify an appropriate technique to structure that discussion such that student learning is most supported. Indeed, by using multiple discussion formats, instructors help all students find their voice and engage more broadly in the process of science. Today's science students continue to struggle with effective professional communication. In-class discussion remains a vital tool to help students learn and master these essential science—and life—skills.

Note

¹ <https://sites.google.com/site/esaworkshops/home/2015-workshop-discussion-in-the-undergraduate-classroom/photos-from-the-rotation-station-discussion-about-preparing-instructors-for-discussion>.

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