



Teaching for Diversity and Equity

Structure Matters: Twenty-One Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity

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(1) Giving students opportunities to think and talk about the course subject

- Wait time
 - Thinking biologically about increasing wait time to promote student engagement and participation, it seems likely that this increase in time allows critical neural processing time for students, and perhaps also allows more introverted students' time to rally the courage to volunteer an answer.
- Allow students time to write
 - One simple way to scaffold wait time is to explicitly require students to write out one idea, two ideas, three ideas that would capture their initial thoughts on how to answer the question posed. This act of writing itself may even lead students to discover points of confusion or key insights.
- Think–pair–share
 - The mechanics of a think–pair–share generally involve giving all students a minute or so to think (or usually write) about their ideas on a question. Then, students are charged to turn and talk with a neighboring student, compare ideas, and identify points of agreement and misalignment. These pair discussions may or may not be followed by a whole-group conversation in which individual students are asked to share the results of their pair discussion aloud with the whole class.
- Do not try to do too much



- One strategy for prioritizing how to spend precious class time is to decide on which biological ideas in a course are most difficult to learn, are rooted in common misconceptions, and/or represent fundamental biological principles

(2) Encouraging, demanding, and actively managing the participation of *all* students

- Hand raising
 - As such, providing structure through something as simple as hand raising can establish a culture that the instructor expects all students to be participating. With hand raising, the instructor can also be explicit about asking for “hands from those of us who haven’t had a chance yet to share” and strive to cultivate a classroom conversation that goes beyond a few students in the front row.
- Multiple hands, multiple voices
 - One simple strategy for broadening participation and increasing the breadth of ideas flowing from students to instructors is to generally ask for multiple hands and multiple voices to respond to any question posed during class time (Allen and Tanner, 2002). Instructors can set the stage for this by asserting, “I’m going to pose a question, and I’d like to see at least three hands of colleagues here who would share their ideas. I won’t hear from anyone until I’ve got those three volunteers.”
- Random calling using popsicle sticks/index cards
 - If the spirit of calling on students feels like a penalty, it may do more harm than good. However, if the instructor is explicit that all students in the course have great ideas and perspectives to share, then random calling on students in courses that range in size from 10 to 700 can be a useful strategy for broadening student participation.
- Assign reporters for small groups
 - Assigning a “reporter”—an individual who will report back on their small-group discussion—is a simple strategy to provide access to verbal participation for students who would not otherwise volunteer. The assignment of reporters need not be complex. It can be random and publicly verifiable, such as assigning that the reporter will be the person wearing the darkest shirt.
- Whip (around)
 - The mechanics of the whip are that the instructor poses a question to which each individual student will respond, with each response usually being <30 s in length. On the first day of class, this could be something as simple as asking students what their favorite memory of learning biology has been.
- Monitor student participation
 - During each class session, instructors can keep a running list—in smaller classes mentally and in larger classes on a piece of paper—of those students who have contributed to the discussion that day, such as by answering or asking a question. When the same students attempt to volunteer for the second, third, or subsequent times, instructors can explicitly invite participation from other students, using language such as “I know that there are lots of good ideas on this in here, and I’d



like to hear from some members of our community who I haven't heard from yet today."

(3) Building an inclusive and fair classroom community for *all* students

- Learn or have access to students' names
 - Some instructors may plead an inability to remember names; however, there are many simple ways to scaffold the use of individual student names in a classroom without memorizing all of them. Having students submit index cards with their names and personal information, as described above, is an easy first step to learning names.
- Integrate culturally diverse and relevant examples
 - Although it is not possible to represent aspects of all students' lives or the cultural background of each student in your course, careful attention to integrating culturally diverse and personally relevant connections to the course subject can demonstrate for students that diverse perspectives are valued in your classroom (Ladson-Billings, 1995).
- Work in stations or small groups
 - For some students, participation in a whole-group conversation may be a persistently daunting experience. However, instructors can structure opportunities for such students to practice thinking and talking about the course subject by regularly engaging students in tasks that require students to work together in small groups. Care must be taken to be explicit with students about the goal of the group work and, whenever possible, to assign roles so that no student in a small group is left out (Johnson *et al.*, 1991, 1993, 1998; Tanner *et al.*, 2003).
- Use varied active-learning strategies
 - The "best" way to teach equitably—providing access to the course subject for the largest number of students—may be to consistently provide multiple entry points into the conceptual material for students. If an instructor chooses a singular teaching approach—always lecturing or always concept mapping, regardless of the nature of the approach—it seems likely that the lack of variation could result in the alienation and exclusion from learning of a subpopulation of students.
- Be explicit about promoting access and equity for *all* students
 - There need not be substantial time spent on conveying this stance, but explicit statements by the instructor about the importance of diverse perspectives in science can make issues of fairness and equity explicit rather than an implicit. Instructors can share with students why they use the teaching strategies they do, for example, sharing the reasoning behind having students write to allow thinking and processing time for everyone

(4) Monitoring (your own and students') behavior to cultivate divergent critical thinking

- Ask open-ended questions
 - One critical tool for instructors aspiring to cultivate divergent biological thinking in their classrooms is the use of open-ended questions, which are those questions that cannot be answered with a simple "yes" or "no" or even easily answered with a single word or phrase. Open-ended questions are by definition those which have



multiple possible responses, such that inviting answers from a large group can yield more than an expected set of responses (Bloom *et al.*, 1956; Allen and Tanner, 2002; Crowe *et al.*, 2008).

- Do not judge responses
 - To create a safe environment that encourages students to share all of their ideas, instructors may be best served in acknowledging student responses as neutrally as possible. This does not require inadvertently supporting a scientifically inaccurate idea. Clearly stating “I’d like to hear from a number of us about our thinking on this, and then we can sort out what we are sure of and what we are confused about,” sets the stage that all the responses may not be correct.
- Use praise with caution
 - With very few syllables spent, instructors may inadvertently convey to the rest of the students who are not participating that the response given was so wonderful that it is impossible to build on or exceed. It suggests using praise with caution is essential, so other students feel that they still have something to add and can be successful in sharing.
- Establish classroom community and norms
 - In this case, “norms” refers to a set of accepted usual, typical, standard acceptable behaviors in the classroom. Common group norms established by experienced instructors include the following: “Everyone here has something to learn.” For many instructors, these classroom norms are simply verbally asserted from the first few days of a class and then regularly reiterated as the term progresses.

(5) Teaching *all* of the students in your classroom

- Teach them from the moment they arrive
 - As such, instructors are best served by considering what students are learning, not just about the subject matter, but also about culture of the classroom from the moment they enter the room. If the course is about learning biology, then instructors can implicitly and explicitly teach this by engaging students in exciting, intellectually challenging, and rewarding experiences about biology on the first day of a course.
- Collect assessment evidence from every student, every class
 - Frequent collection of assessment evidence—about students’ biological ideas, about their reflections on their learning, about their struggles in the course—is essential for instructors to know the learners they are trying to teach. While the nature of the assessment evidence may vary from class session to class session, the evidence collected from each and every student in a course can aid instructors in continuously re-evaluating student ideas and iteratively changing the arc of the course to best support the learning of that course’s student population.

