

Structure Matters: 21 Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity

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The Science Education
Partnership & Assessment Lab
San Francisco State University



SAN FRANCISCO
STATE UNIVERSITY

Who are we?

**What are three important
things to know about
who you are and what
you value?**

**Please share in the chat
window!**

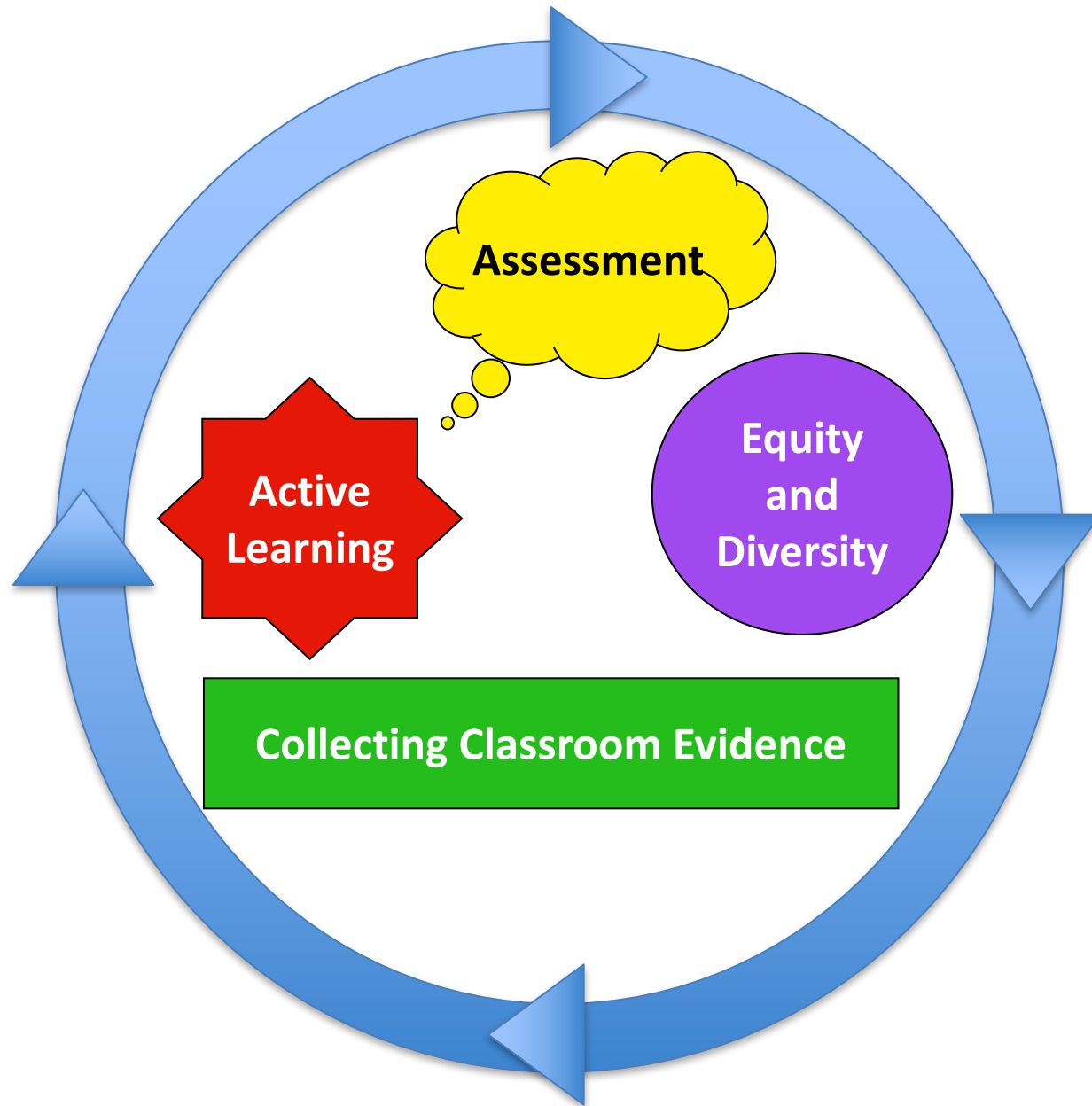
Kimberly: Neuroscientist, FirstGenCollegeGoing, Mom

Ideas that Drive SEPAL Research

- Twice as many undergraduates leave the sciences as the humanities in the U.S.
- Women and scientists of color continue to be underrepresented in the sciences
- Few scientists have formal training in teaching
- Research in biology education lags behind other science disciplines, but suggests students not learning and leaving...



Scientific Teaching Framework





A Plan for Our Time Together...

- **Introductions**
- **What can exclusion look like?**
- **21 Teaching Strategies to Promote Student Engagement, Classroom Fairness, and Inclusion**
- **Another Consideration: Instructor Talk...**
- **Another Resource: Scientist Spotlights**

**Questions, Insights, Resources to
Share, and Comments are
WELCOME THROUGHOUT!!**

For Your Consideration: Rock Stars of Science...



Sample advertisement portraits from the 2009 *Rock Stars of Science* campaign by Geoffrey Beene Gives Back. (Photo credit: Geoffrey Beene Gives Back, GQ, and Ben Watts, Photographer)

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For Your Consideration: Rock Stars of Science...



**What do you notice
about the
photographs from the
Rock Stars of Science
Campaign?**

**What messages might
these images send to
young people?**

Sample advertisement portraits from the 2009 *Rock Stars of Science* campaign by Geoffrey Beene Gives Back. (Photo credit: Geoffrey Beene Gives Back, GQ, and Ben Watts, Photographer)



“That moment changes the way you see the world for the rest of your life.”

For Your Consideration: Rock Stars of Science...




There are 11 scientists featured.

All 11 appear to be male.

All 11 appear to be white.

**“It kind of says that women and people of color are more likely to be rock stars than scientists, huh?”
– undergraduate woman of color**



What else can exclusion look like in a classroom?

In what other ways can students feel left out and excluded in science classrooms?

Please share in the chat window!

The Results of Unstructured Classroom Environments

CBE—Life Sciences Education
Vol. 13, 478–492, Fall 2014

Article

Gender Gaps in Achievement and Participation in Multiple Introductory Biology Classrooms

Sarah L. Eddy,^{*†} Sara E. Brownell,^{†‡} and Mary Pat Wenderoth^{*}

^{*}Department of Biology, University of Washington, Seattle, WA 98195; [†]School of Life Sciences, Arizona State University, Tempe, AZ 85287



RESEARCH ARTICLE

Males Under-Estimate Academic Performance of Their Female Peers in Undergraduate Biology Classrooms

Daniel Z. Grunspan^{1*}, Sarah L. Eddy^{2*}, Sara E. Brownell³, Benjamin L. Wiggins⁴, Allison J. Crowe⁴, Steven M. Goodreau¹

¹ Department of Anthropology, University of Washington, Seattle, WA, 98185, United States of America, ² Texas Institute for Discovery Education in Science, College of Natural Sciences, University of Texas at Austin, Austin, TX, 78712, United States of America, ³ School of Life Sciences, Arizona State University, Tempe, AZ, 85287, United States of America, ⁴ Department of Biology, University of Washington, Seattle, WA, 98195, United States of America





Big Idea: Structuring Learning Environments Promotes Fairness, Equity, and Access for All Students

Unstructured learning environments can lead to unfairness, feelings of exclusion, and collisions of students' cultural backgrounds with the learning environment.

Adding structure to learning environments can mitigate unfairness, promote feelings of inclusion, and promote student success.



Big Idea: Questioning Assumptions about Origins of Student Behaviors

Moving away from assumptions that students are lacking...




**STUDENT
DEFICIT
MODEL**

Moving towards the idea that learning environments are lacking (in structure)...



**LEARNING
ENVIRONMENT
DEFICIT MODEL**



**But Kimberly,
what can I do tomorrow
to make my classroom,
lab meeting, faculty meeting,
(name any number of professional science
environments...conferences, seminar talks, etc),
more fair and more inclusive?!?!**

CBE—Life Sciences Education
Vol. 12, 1–10, Fall 2013

Feature

Approaches to Biology Teaching and Learning

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

Kimberly D. Tanner

Department of Biology, San Francisco State University, San Francisco, CA 94132



21 Strategies That Structure Learning Environments and Promote Fairness in Undergraduate Classrooms

***Giving All Students Opportunities to Think and Talk About Science** (n=4)*

***Encouraging, Demanding, and Actively Managing the Participation of All Students** (n=6)*

***Building an Inclusive and Fair Classroom Community for All Students** (n=5)*

***Monitoring Our Own Behavior to Cultivate Divergent Thinking** (n=4)*

***Teaching All of the Students in Your Classroom/Context** (n=2)*



21 Strategies That Structure Learning Environments and Promote Fairness in Undergraduate Classrooms

What are strategies we can use to... **give all students opportunities to think and talk about science?**

Please share in the chat window!

- 1. Wait Time**
- 2. Allow Students Time to Write**
- 3. Think-Pair-Share**
- 4. Don't Plan Too Much**



Giving All Students Opportunities to Think and Talk About Biology

- 1. Wait Time:** pause for 3 to 5 seconds (longer than you think!) after you ask a question before you call on anyone to speak or answer the question yourself. Longer wait times will allow more students thinking time.
- 2. Allow Students Time to Write:** an opportunity to write down their ideas on paper helps many students revisit what they know, formulate question, and rehearse what they may want to share, increasing participation.
- 3. Think-Pair-Share:** providing an opportunity for students to first think quietly and then share their ideas with a partner can help students rehearse and build confidence to share with the whole class, increasing participation.
- 4. Don't Plan Too Much:** students need TIME to think, do, and talk about what they are learning.



21 Strategies That Structure Learning Environments and Promote Fairness in Undergraduate Classrooms

**What are strategies we can
use to... encourage,
demand, and actively
manage the participation of
all students?**

**Please share
in the chat
window!**

- 5. Hand Raising**
- 6. Multiple Hands, Multiple Voices**
- 7. Use Popsicle Sticks/Index Cards**
- 8. Assign Reporters for Small Groups**
- 9. Whip (Around)**
- 10. Monitor Student Participation**



Encouraging, Demanding, & Actively Managing the Participation of All Students

- 5. Hand Raising:** in large group discussions, have students raise their hands. Avoid unstructured speaking situations where a subset of students can dominate. Work to call on all students who haven't yet spoken.
- 6. Multiple Hands, Multiple Voices:** after you ask a question, say that you'll wait for at least 3 students to raise their hands before you call on anyone, and then really wait for 3 hands to promote more participation.
- 7. Use Popsicle Sticks/Index Cards:** write the name of every student in your class on an individual popsicle stick/index card and put in a cup. When asking a question, pull out 2-5 sticks to randomly call on students.
- 8. Assign Reporters for Small Groups:** assign who will speak on behalf of a small group. Randomly determine this by assigning the reporter as the person who has the longest hair, darkest shirt, upcoming birthday, etc.
- 9. Whip (Around):** ask a question that has many possible answers and have every student share his/her brief answer.
- 10. Monitor Student Participation:** pay attention to which students are or are not participating. Actively encourage student participation and ask to hear from students you haven't yet heard from




21 Strategies That Structure Learning Environments and Promote Fairness in Undergraduate Classrooms

What are strategies we can use to... build an inclusive and fair classroom community?

Please share in the chat window!


- 11. Learn Students' Names**
- 12. Integrate Culturally Diverse Examples**
- 13. Work in Stations/Small Groups**
- 14. Use Varied Active Learning Strategies**
- 15. Be Explicit About Promoting Access and Equity for All Students**



Building an Inclusive and Fair Biology Classroom Community

- 11. Learn Students' Names:** know your students' names and use them. Only knowing some students names can make others feel like they don't belong. Avoid calling on groups by one person's name (e.g. Billy's group).
- 12. Integrate Culturally Diverse and Relevant Examples:** connect the concepts you are teaching to real-world examples that span diverse communities and cultures. Show images of culturally diverse people in your class.
- 13. Work in Stations/Small Groups:** to decrease effective class size and provide more opportunity for interaction and discussion, consider organizing multiple activities as stations that small groups rotate through.
- 14. Use Varied Active Learning Strategies:** hands-on activities, think-pair-shares, jigsaw discussions, group presentations, & case studies provide more points of access for students than a teacher-centered lectures.
- 15. Be Explicit About Promoting Access and Equity for All Students:** Share with students why you use the teaching strategies that you use. Let them know that you want and expect everyone to learn.

21 Strategies That Structure Learning Environments and Promote Fairness in Undergraduate Classrooms



What are strategies we can use to... monitor our own behavior to cultivate divergent thinking?

Please share in the chat window!

16. Ask Open-ended Questions

17. Don't Judge Responses

18. Use Praise with Caution

19. Establish Classroom Community & Norms



Monitoring Behavior to Cultivate Divergent Biological Thinking

- 16. Ask Open-ended Questions:** instead of asking verbal questions with only one possible answer (closed-ended questions), ask questions with multiple possible answers (open-ended questions).
- 17. Don't Judge Responses:** encourage students to honestly share their ideas. Avoid immediately correcting wrong answers or incorrect ideas. Student misconceptions can be addressed at a later point in time.
- 18. Use Praise with Caution:** “excellent job” and “great answer” can inadvertently discourage other students from participating if they think they can't do better than the previous student's response.
- 19. Establish Classroom Community and Norms:** explicitly state that students should work together, help each other, share resources, support one another's learning, and be open to divergent points of view.




21 Strategies That Structure Learning Environments and Promote Fairness in Undergraduate Classrooms

**What are strategies we can
use to... teach all the
students in our
classrooms/contexts?**

**Please share
in the chat
window!**

- 20. Teach Students from the Moment They Arrive**
- 21. Collect Assessment Evidence from Every Student, Every Class**



Teaching All of the Students in Your (Biology) Classroom/Context

- 20. Teach Students from the Moment They Arrive:** remember that students are learning about classroom culture in addition to biological concepts as soon as they enter the classroom.
- 21. Collect Assessment Evidence from Every Student, Every Class:** increase the flow of information from students to instructor by collecting an index card question or an online reflection every class to gauge student learning, student confusions, and student perspectives on their experiences. Grade for participation only!



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**Just a place to start!
So many more...**



21 Strategies That Structure Learning Environments and Promote Fairness in Undergraduate Classrooms

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In what other professional settings could you use these strategies to promote inclusion?

Please share in the chat window!



Another Consideration: Instructor Talk...

Beyond the Biology: A Systematic Investigation of Noncontent Instructor Talk in an Introductory Biology Course

Shannon B. Seidel,^{*,†} Amanda L. Reggi,^{*} Jeffrey N. Schinske,[‡] Laura W. Burrus,^{*} and Kimberly D. Tanner^{*}

^{*}Department of Biology, San Francisco State University, San Francisco, CA 94132; [†]Department of Biology, Pacific Lutheran University, Tacoma, WA 98447; [‡]Department of Biology, De Anza College, Cupertino, CA 95014

"I don't have a special email for you guys. You get the same email as my research colleagues and friends get. So anytime you want to email me, you use that."

"Some of the most important people in this room for you to be successful in [this course] are sitting around you, okay? They're not up on the stage."

"Some people find that if you haven't had a basic biology class before coming in here, it's a little harder. You've got to learn some of those basic concepts a little faster than other folks."

"You don't need to sneak in. You're right on time today for a change."

Another Resource: Scientist Spotlights...

Scientist Spotlight Homework
Assignments Shift Students' Stereotypes
of Scientists and Enhance Science Identity
in a Diverse Introductory Science Class
Jeffrey N. Schinske,^{1*} Heather Perkins,² Amanda Snyder,³ and Mary Wyer²
¹Biology Department, De Anza College, Cupertino, CA 95014; ²Psychology Department, North Carolina State University, Raleigh, NC 27695

Jeffrey N. Schinske, M.S.

Tenured Biology Instructor
Foothill-De Anza Community
College District

Biol 640: Cellular Neuroscience

Neuroscientist Journal Prompt #19

DUE by 11:55pm on Sunday, April 23rd, 2017

Your entry should be *at least* 400 words total, split between the questions at the bottom of the page.

Scientist Spotlight: Carl Hart



Carl Hart is a neuroscientist who is a professor in the departments of Psychology and Psychiatry at Columbia University. His research, which some people consider controversial, focuses on the neurobiological and behavioral effects of drugs and the biological, psychological, and social factors that influence drug use. He is also a leading advocate of changing American drug policy and drug law enforcement so that they are less discriminatory against communities of color and better reflect what science and evidence shows about drugs.

1) Please read the Prologue from Dr. Hart's book *High Price: A Neuroscientist's Journey of Self-Discovery that Challenges Everything You Know about Drugs and Society*, republished with his permission here: <http://www.alternet.org/i-went-selling-drugs-studying-them-and-found-most-what-we-assume-about-drugs-wrong>

2) Please read Dr. Hart's paper "Alternative reinforcers differentially modify cocaine self-administration by humans," (Hart et al, *Behavioural Pharmacology*, 2000) posted on iLearn.

If you'd like to know a little bit more about his particular paper, an article (with a video of an interview with Dr. Hart) is here: <http://www.nytimes.com/2013/09/17/science/the-rational-choices-of-crack-addicts.html>

(If you are interested in hearing more from Carl Hart, you can go to his website drcarlhart.com, where he has extensive links to his videos and writings.)

After reviewing these articles, write a 400 word or more reflection with your responses to what you read. You might wish to discuss:

1. What was most interesting or most confusing about the articles about Dr. Hart?
2. What can you learn about the biological basis of drug addiction from these articles?
3. What do these articles tell you about the types of people that do science?
4. What new questions do you have after reviewing these articles?

For Further Reading...



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Feature

Approaches to Biology Teaching and Learning

Considering the Role of Affect in Learning: Monitoring Students' Self-Efficacy, Sense of Belonging, and Science Identity

Gloriana Trujillo and Kimberly D. Tanner

Feature

Approaches to Biology Teaching and Learning

Cultural Competence in the College Biology Classroom

Kimberly Tanner* and Deborah Allen†


CBE—Life Sciences Education
Vol. 8, 265–270, Winter 2009

Feature

Approaches to Biology Teaching and Learning

Learning to See Inequity in Science

Kimberly D. Tanner



Thank you for choosing to spend your time with me today...

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