SEPAL
The Science Education Partnership & Assessment Laboratory
San Francisco State University

SEPAL Scientific Teaching Summer Institute

Tuesday, August 23, 2022

Day 1: Intro to Scientific Teaching; Assessment

Today's Learning Outcomes…

- Get to know your 2022 Stanford Scientific Teaching Institute colleagues!
- Discuss the relationship between innovative teaching and the biological basis for learning.
- Investigate evidence that suggests changes in undergraduate STEM teaching are necessary.
- Explore principles of Backwards Design in planning courses and lessons.
- Construct a common understanding of "assessment" and its role in learning.
- Compare and contrast different forms of assessment tools for uncovering student ideas.
- Examine Bloom's Taxonomy as a tool for evaluating and modifying assessments.
- Apply Bloom's Taxonomy to individual class contexts.

9:00 - 9:40	**Introductions: Getting to Know You…**
9:40 - 9:50	**Reflection: A Time to Reflect on Your Own…**
9:50 - 10:00	**Big Idea: Summer Institute Overview and Scientific Teaching Framework**
**10 min - Bathroom Break **	
10:10-10:40	**A Common Experience: Keeping Your Eye on the Big Picture**
10:40 – 10:55	**Discussion: Content Coverage and Prioritizing Student Learning Outcomes**
10:55 - 11:25	**Big Idea and Movie: On Myth of Content Coverage**
11:25 - 12:00	**Big Idea: Problems with Undergraduate Science Education**
12:00 - 12:10	**Big Idea: Focusing on a Single Course & Thinking about the Future…**
12:10 - 12:55	**LUNCH**
12:55 - 1:10	**Big Idea: Using Backwards Design to Prioritize What to Teach**
1:10 - 1:40	**Activity: The Purpose of Assessment and the Role of Questions**
1:40 - 2:15	**Activity: Assessment A-Go-Go Part 1**
**10 min - Bathroom and Snack Break **	
2:25-3:00	**Activity: Assessment A-Go-Go Part 2**
3:00 - 3:30	**Activity: Exploring Bloom's Taxonomy**
3:30 - 4:15	**Activity: Analyzing Our Exams/Quizzes Using Bloom's Taxonomy**
4:15 - 4:30	**Big Idea and Activity: Teaching Action Plans and Wednesday Posters**
4:30 - 5:00	**Closing & Reflection**

Turn over for **Resource Readings** →

→ **Resource Readings**:

1. Wiggins, Grant, Grant P. Wiggins, and Jay McTighe. *Understanding by design*. Ascd, 2005.

2. Miller, Sarah, et al. "Scientific teaching in practice." *Science*322.5906 (2008): 1329-1330

3. Zheng, Alex Y., et al. "Application of Bloom's taxonomy debunks the" MCAT myth"." *Science* 319.5862 (2008): 414-415.

4. Handelsman, Jo, Sarah Miller, and Christine Pfund. *Scientific teaching*. Macmillan, 2007. (Ch. 3 – Assessment)

5. Schinske, Jeffrey N. "Taming the testing/grading cycle in lecture classes centered around open-ended assessment." *Journal of College Science Teaching* 40.4 (2011).

6. Schinske, Jeffrey, and Kimberly Tanner. "Teaching more by grading less (or differently)." *CBE—Life Sciences Education*13.2 (2014): 159-166.

7. Freeman, Scott, et al. "Active learning increases student performance in science, engineering, and mathematics." *Proceedings of the National Academy of Sciences* 111.23 (2014): 8410-8415.

8. Halloun, Ibrahim Abou, and David Hestenes. "The initial knowledge state of college physics students." *American journal of Physics* 53.11 (1985): 1043-1055.

9. Shaffer, Justin F., et al. "A familiar (ity) problem: Assessing the impact of prerequisites and content familiarity on student learning." *PloS one* 11.1 (2016): e0148051.

10. Owens, Melinda T., and Kimberly D. Tanner. "Teaching as brain changing: Exploring connections between neuroscience and innovative teaching." *CBE—Life Sciences Education* 16.2 (2017): fe2.

11. Brewer, Carol A., and Diane Smith. "Vision and change in undergraduate biology education: a call to action." *American Association for the Advancement of Science, Washington, DC*(2011).

12. Brownell, Sara E., et al. "BioCore Guide: a tool for interpreting the core concepts of Vision and Change for biology majors." *CBE—Life Sciences Education* 13.2 (2014): 200-211.

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Wednesday, August 24, 2022

Day 2: Inclusion, Equity, & Diversity

Today's Learning Outcomes…

- Explore how issues of inclusion, equity, and diversity affect student learning.
- Experience how unstructured classroom environments can work against inclusiveness, fairness, and equity.
- Discuss recent inclusion research in science education and related fields.
- Self-assess current awareness of and use of common equitable teaching strategies.
- Investigate group behaviors that can influence inclusiveness, fairness, equity.

9:00 - 9:15	**Welcome and Reflections from Day 1**
9:15 - 10:15	**Activity: Building Mobiles Part 1**
**10 min - Bathroom Break **	
10:25 - 11:05	**Activity: Building Mobiles Part 2**
11:05 - 12:00	**Activity: The Invisible Variable of Instructor Talk**
12:00 - 12:45	**LUNCH**
12:45 - 1:25	**Activity: Exploring 21 Simple Classroom Equity Strategies**
1:25 - 1:45	**Rock Stars of Science**
**10 min - Bathroom Break **	
1:55 - 3:15	**Inclusion Research Jigsaw**
3:15 - 3:30	**Videos: Final Thoughts on Inclusion Research and the Value of Diversity in Science**
**10 min - Bathroom and Snack Break **	
3:40 - 4:30	**Big Idea: Scientist Spotlights**
4:30 - 4:50	**Activity: Continuation of Teaching Action Plans**
4:50 - 5:00	**Closing & Reflection**

Turn over for **Optional Pre-Reading** and **Resource Readings** →

→ Optional Pre-Reading:

Tanner, KD. "Order matters: using the 5E model to align teaching with how people learn." *CBE—Life Sciences Education* 9.3 (2010): 159-164.

→ Resource Readings:

1) Handelsman, Jo, Sarah Miller, and Christine Pfund. *Scientific teaching*. Macmillan, 2007. (Ch. 4 – Diversity)

2) Tanner, Kimberly, and Deborah Allen. "Cultural competence in the college biology classroom." *CBE—Life Sciences Education* 6.4 (2007): 251-258.

3) Chamany, Katayoun, Deborah Allen, and Kimberly Tanner. "Making biology learning relevant to students: integrating people, history, and context into college biology teaching." *CBE—Life Sciences Education* 7.3 (2008): 267-278.

4) Trujillo, Gloriana, and Kimberly D. Tanner. "Considering the role of affect in learning: Monitoring students' self-efficacy, sense of belonging, and science identity." *CBE—Life Sciences Education* 13.1 (2014): 6-15.

5) Tanner, Kimberly D. "Structure matters: twenty-one teaching strategies to promote student engagement and cultivate classroom equity." *CBE—Life Sciences Education* 12.3 (2013): 322-331.

6) Haak, David C., et al. "Increased structure and active learning reduce the achievement gap in introductory biology." *Science*332.6034 (2011): 1213-1216.

7) Schinske, Jeffrey N., et al. "Scientist spotlight homework assignments shift students' stereotypes of scientists and enhance science identity in a diverse introductory science class." *CBE—Life Sciences Education* 15.3 (2016): ar47.

8) Grunspan, Daniel Z., et al. "Males under-estimate academic performance of their female peers in undergraduate biology classrooms." *PloS one* 11.2 (2016): e0148405.

9) Moss-Racusin, Corinne A., et al. "Science faculty's subtle gender biases favor male students." *Proceedings of the National Academy of Sciences* 109.41 (2012): 16474-16479.

10) Miyake, Akira, et al. "Reducing the gender achievement gap in college science: A classroom study of values affirmation." *Science* 330.6008 (2010): 1234-1237.

11) Canning, Elizabeth A., et al. "STEM faculty who believe ability is fixed have larger racial achievement gaps and inspire less student motivation in their classes." *Science advances* 5.2 (2019): eaau4734.

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Thursday, August 25, 2022

Day 3: Active Learning; Looking to the Future

Today's Learning Outcomes…

- Construct a common understanding of "active learning."
- Experience and evaluate different amounts of time required for integrating active learning into a lecture.
- Use the 5E model to analyze and modify a class session, identifying opportunities for active learning.
- Applying active learning strategies to individual class contexts.
- Reflect on how the Summer Institute is and is not likely to influence our professional work.
- Compose a plan for implementing small changes in our professional work based on Scientific Teaching.
- Set expectations for future activities and create individual plans.

9:00 - 9:10	**Welcome and Reflections from Day 2**
9:10 - 9:25	**Brainstorm and Video: What Can Active Learning Look Like in a Lecture?**
9:25 - 10:35	**Activity: Active Learning in 1, 5, 10, and 20 Minutes During a Lecture**
******10 min - Bathroom Break* *****	
10:45 - 11:05	**Activity: How to Thoughtfully Integrate Active Learning**
11:05 - 11:20	**Mini-Lecture: The 5 E's**
11:20 - 11:30	**Activity: Assigning E's to an Individual Class Session**
11:30 - 11:40	**Discussion: Strategies for Using the 5E Model to Iteratively Change a Lesson**
11:40 - 12:00	**Activity: Tweak Your Lesson!**
12:00 - 12:30	**Activity: A Self-Assessment Tool for Active Learning**
12:30 - 1:25	**LUNCH and Group Photo**
1:25 – 2:05	**Carousel Graffiti: What Will You Use in Your Classroom?**
******10 min - Bathroom and Snack Break* *****	
2:15 - 2:50	**Poster Creation**
2:50 - 3:55	**Poster Session**
3:55 - 4:15	**Final Reflection**
4:15 - 4:40	**Celebration & Closing**
4:40 - 4:45	**Final Announcements**

Turn over for **Resource Readings** →

→ **Resource Readings**:

1) Handelsman, Jo, Sarah Miller, and Christine Pfund. *Scientific teaching*. Macmillan, 2007. (Ch 2- Active Learning)

2) Smith, Michelle K., et al. "Why peer discussion improves student performance on in-class concept questions." *Science*323.5910 (2009): 122-124.

3) Bransford, John, Suzanne Donovan, and James W. Pellegrino. *How people learn: Bridging research and practice*. National Academies Press, 1999.

4) Allen, Deborah, and Kimberly Tanner. "Infusing active learning into the large-enrollment biology class: seven strategies, from the simple to complex." *Cell biology education* 4.4 (2005): 262-268.

5) Silverthorn, Dee U. "Teaching and learning in the interactive classroom." *Advances in Physiology Education* 30.4 (2006): 135-140.

6) Seidel, Shannon B., and Kimberly D. Tanner. "“What if students revolt?”—considering student resistance: origins, options, and opportunities for investigation." *CBE—Life Sciences Education* 12.4 (2013): 586-595.

7) Wood, William B. "Innovations in teaching undergraduate biology and why we need them." *Annual Review of Cell and Developmental* 25 (2009): 93-112.

8) Owens, Melinda T., et al. "Classroom sound can be used to classify teaching practices in college science courses." *Proceedings of the National Academy of Sciences* 114.12 (2017): 3085-3090.