10 Lessons Learned from the Science Classroom

Experience with high-stakes accountability informs teacher's standards setting on the state board.

Ryan Fuhrman

I am no expert in science standards. But as a former junior high science teacher who started his career the same year that No Child Left Behind (NCLB) became law in 2002 and who now serves as chair of the Wyoming State Board of Education, I have a perspective to share. Wyoming, like many other states, is wrestling with the legacy of high-stakes testing ushered in by NCLB, the resulting rigorous standards of Common Core, and now the opportunities offered by the Every Student Succeeds Act (ESSA). The Wyoming state board is grappling with the best approach to revising standards, including for math and science, in a system that still has components from earlier reforms.

I often liken the current education system to Johnny Cash's famous song, "One Piece at a Time," about cobbling together a Cadillac that had been snuck out of the factory one piece at a time over many years.

Now, up to now my plan went all right
'Til we tried to put it all together one night
And that's when we noticed that something was definitely wrong
The transmission was a '53 and the motor turned out to be a '73
And when we tried to put in the bolts all the holes were gone
So we drilled it out so that it would fit
And with a little bit of help with an adapter kit

Every year a different legislature, board, or standards committee adds a piece to the system, and educators work to make sure everything is as aligned as possible.

The Wyoming state board is tackling this issue head on. Recent guidance from the state attorney general tasked the state board with developing specific standards for graduation. Realizing the systemic impact of such changes, the state board is working to set standards by 2023 that not only will produce students worthy of walking across the stage at graduation but also students ready to walk out of school as healthy, contributing members of our communities. Before we can do that, we have to first distill our thinking into a Profile of a Graduate. And before we can do that, we have to take a step back to listen to stakeholders. Is the system aligned to their goals for it?

As I help lead this work, I can't help but reflect on my own career journey. Having now spent almost two decades in education, I would like to share lessons gained along the way that inform my work on the state board.

I remember walking into my "new" eighth grade classroom a week before the students showed up that fall of 2002. It was in an old high school and had one outlet and no sink. When I asked the principal, "What do I teach?" he pointed to a cupboard of old textbooks and unhelpfully replied, "Here are the books," and added, "The standards are so general you can teach whatever you want to cover."

During those first years, I was never encouraged to work with other teachers. Instead, I had complete freedom to either follow the textbook I had or take a wild swing for the fence. Like any fresh-out-of-college, former camp counselor, I swung for the fence. When the Jet Propulsion Laboratory rovers *Spirit* and *Opportunity* landed on Mars in 2003, my science classroom followed every update in the early mission days (we did not realize that the original 90-day mission would last until 2010 for *Spirit* and *Opportunity*, amazingly, until 2018). My students were hanging out our

window as they tested their designs for landing a rover (an egg) onto the surface of Mars (the sidewalk below the window) when the other science teacher brought out his class to watch. His lesson for the day was to watch mine.

Lesson 1: Without rigorous standards and accountability, some teachers will take opportunities to innovate and follow student interests.

Lesson 2: Without rigorous standards and accountability, some teachers will phone it in.

Science, history, and all the other subjects were the chorus line for the main characters, English and Math.

As for many teachers, NCLB and the resulting high-stakes testing altered my teaching. I went from the freedom to design my own scope and sequence to sweating over what random assortment of science facts would be quizzed on the Colorado Student Assessment Program (CSAP) in the spring. Even though science was not under the microscope of NCLB, I nonetheless felt the pressure for our school to raise its reading and math scores. We became "targeted" in our approach. Everybody, including PE teachers, was responsible for additional writing practice. I worked to master and assign formulaic Step up to Writing paragraphs to assist.

One moment from that era has stayed with me: In a fall conference with a student, I admonished him for a low CSAP score that seemed below the ability that I knew he had displayed in class. His reply—that testing day fell a day after he received news that his brother had died in the Iraq War—was a punch to the gut. How can we let one day define our students?

Lesson 3: Accountability pressures affect all aspects of school. Schools will narrow their focus to try to boost scores.

Lesson 4: Placing all the weight of accountability on one day of testing is wrong.

After six years in Colorado, where I got my initial introduction to content standards, I moved my family back to my home state of Wyoming and started teaching at a rural K-8 school on the edge of a large (for Wyoming) urban district. For four years, I wasn't just the science teacher, I was the science department. The focus on testing—this time the Proficiency Assessment of Wyoming Students, or PAWS—did not change. I taught science but professional development and energy went toward assisting reading, writing, and math. Given that state standards were pretty basic, I had to predict what science content would show up on the PAWS at the end of four years of science instruction (science tests were administered only in grades 4, 8, and 10).

I found myself teaching a reading group. I also became a member of a new professional learning community (PLC), something that was also happening in Sheridan, where they were getting great test results. Our PLC was focused on tested skills, so science, history, and all the other subjects were the chorus line for the main characters, English and Math. The district even went so far as to require kits to help K-8 teachers follow their science curriculum. That was too much for me. I applied to work in Sheridan, the state's top-performing district and home to its best PLCs.

Lesson 5: Ham-handed efforts to support teachers can leave them uninspired and ready to exit.

Lesson 6: PLCs can be a real waste of time without strong leadership and focus.

When I joined my current school, Sheridan Junior High, as their new science teacher in 2012, I quickly realized that what my former district called a PLC was a mere shadow of what a true, focused PLC could be. Additionally, and more important, the games that my previous districts were playing to boost test scores were shots in the dark compared with the systematic focus on supporting teachers in a collaborative environment to discover and use best practice.

I was a good teacher, but I had never before sat in a meeting with other teachers to answer the question, "What do we want our students to know?"[1] Before, I had used state learning standards as a checklist to see whether what I wanted to teach fell under its broad umbrella. But now standards became a key component of my planning.

The other world-changing aspect of teaching in Sheridan was our leaders' belief that professional development for educators should be more than a "sit and get" during a professional development day. Instead, teachers were supported to organize their own book studies. The book that changed my life was *Creating Cultures of Thinking* by Harvard researcher

Ron Ritchhart.[2] It revealed to me that what I had been calling teaching was not the same as learning. In teaching, I was most interested in transferring what I knew to students as efficiently as possible. After the book study, I wanted to learn what was happening in the minds of my students. One of the most basic examples is simply asking what has been called the golden question, "What makes you think that?"

To teach the standard on phase changes, for example, I had students collect a beaker of snow, place it on a burner, and chart changes in temperature as it went from melting to boiling. They could all chart the temperature change and dutifully identify when phase changes happened. But then I asked them what they thought was in the bubbles forming at the bottom of the heating water. Most students thought the bubbles contained oxygen or air. Their answers exposed the blind spot in my teaching: The correct answer is that the bubbles contained water vapor. This aha moment led me to pivot my instruction. I credit the support of this PLC, coupled with a shift in focus on learning, for my being named teacher of the year in 2017 and then landing on the Wyoming state board, which has seats reserved for a current teacher, a local board member, a district-level administrator, a business member, and for each of the state judicial districts.

Lesson 7: Teachers can be empowered to work collectively to use the standards as the basis of their teaching. It requires district leadership and support that honors the teacher's expertise.

Lesson 8: How students learn matters greatly. Standards alone will not address this.

The Wyoming board adopted new science standards in 2016. They were closely modeled on the Next Generation Science Standards (NGSS). Like many teachers, I assumed that "the department" was responsible for them. But I soon found myself on the state board of education, and thus I was learning how to drive the standards-setting process while I was also in the classroom working to implement the new standards. I had to be able to see both the trees and the forest, to make a new metaphor.

As members of a strong department at a district actively working to empower teachers, my colleagues and I were trained to "unpack" the new standards, identifying key standards that we could leverage for deeper learning or that were essential for enduring understanding.[3] As my PLC worked to align our teaching to the new standards, I was impressed with the exacting detail that the NGSS inspired. Gone was the broad umbrella of topics. Instead, there were specific skills that teachers would help students master. Modeling became more than a solar system made of Styrofoam balls. It was introduced as the tool scientists use to explain and test phenomena. Writing focused on making scientific claims supported by evidence rather than creating generic paragraphs to prepare for a state test.

As I worked to master the new standards in the classroom, I was also working to master the standards creation and adoption process at the state level. In Wyoming, there is a robust system that involves committees of educators and collection of public and educator feedback (a product of earlier efforts to calm the Common Core uproar). The problem I found was the dearth of real feedback. Teachers were operating as I had before joining the board. They were galloping through the many standards during their workday, then complaining about their number, focus, or lack of focus. They did not realize that failure to seize opportunities to provide input or get involved meant that they were in part responsible for the resulting standards.

Lesson 9: Quality standards matter.

Lesson 10: There are too many standards for deep learning and for teachers to explore the opportunities.

I am in my sixth and final year on the Wyoming state board. Using the lessons learned along the way, I try to make the various parts work a little better with an "adaptor kit." My experiences and journey have informed me, but they also remind me that I am but one teacher with a particular set of experiences with state learning standards. It is essential that we as a state board actively seek classroom perspectives, from both educators and students. Since embarking on developing a Profile of a Graduate, we have done just that. Innovative educators and students have shared how they are navigating the current system

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K-Shaped Recovery" (McKinsey & Company, December 17, 2021).

[4]Robert S. Siegler et al., "Early Predictors of High School Mathematics Achievement," *Psychological Science* 23, no. 7 (2012): 691–97.

[5]TNTP, "The Opportunity Myth: What Students Can Show Us about How School Is Letting Them Down—and How to Fix It," web page (2018), https://tntp.org/publications/view/student-experiences/the-opportunity-myth.

[6]Curriculum Associates, "Academic Achievement at the End of the 2020–2021 School Year: Insights after More Than a Year of Disrupted Teaching and Learning," research brief (North Billerica, MA: Author, June 2021), https://www.curriculumassociates.com/-/media/mainsite/files/i-ready/iready-understanding-student-needs-paper-spring-results-2021.pdf; Karyn Lewis et al., "Learning during COVID-19: Reading and Math Achievement in the 2020–21 School Year," brief (NWEA Center for School and Student Progress, July 2021); Renaissance Learning, "How Kids Are Performing: Tracking the School-Year Impact of COVID-19 on Reading and Mathematics Achievement," special report series (Wisconsin Rapids, WI: Author. Spring 2021 edition).

[7]Curriculum Associates, "Understanding Student Learning: Insights from Fall 2021," Research Report No. 2021-17 (North Billerica, MA: Author, November 2021), https://www.curriculumassociates.com/-/media/mainsite/files/i-ready/iready-understanding-student-learning-paper-fall-results-2021.pdf.

[8]Curriculum Associates, "Academic Achievement at the End of the 2020–2021 School Year."

[9]Siegler et al., "Early Predictors."

[10]Matt Dawson, "The Impact of COVID-19 on Student Academic Growth in 2020-2021," Curriculum Associates Research Report No. 19 (North Billerica, MA: Curriculum Associates, December 2021), https://www.curriculumassociates.com/-/media/mainsite/files/i-ready/iready-covid growth-research-paper-2021.pdf.

[11]Arizona Department of Education, "Arizona Department of Education Releases Statewide Assessment Results from School Year 2020/2021," press release, August 27, 2021.

[12]Virginia Department of Education, "2020–2021 SOL Test Results Reflect National Trends, Unprecedented Challenges," press release, August 26, 2021.

[13]National Council of Teachers of Mathematics, "Moving Forward: Mathematics Learning in the Era of COVID-19" (Reston, VA: NCTM, June 2020), https://www.nctm.org/uploadedFiles/Research_and_Advocacy/NCTM_NCSM_Moving_Forward.pdf.

[14]National Council of Teachers of Mathematics, *Principles to Actions: Ensuring Mathematical Success for All* (Reston, VA: NCTM, 2015).

cont'd from page 17...The Urgent Need for Tailored Math Instruction

[9]Alanna Bjorklund-Young and Jay Plasman, "Reducing the Achievement Gap: An Empirical Analysis of Middle School Math Performance in Six States and Washington, D.C.," (Baltimore: Johns Hopkins University School of Education, April 2019).

[10]Chrys Dougherty and Steve Fleming, "Getting Students On Track to College and Career Readiness: How Many Catch Up from Far Behind?" ACT, November 2012, eric.ed.gov/?id=ED542022.

[11]Nebraska Department of Education, "NSCAS Growth," web page (updated November 29, 2021), https://www.education.ne.gov/assessment/nscas-growth/; State of Georgia, "Innovative Assessment Demonstration Authority (IADA) Annual Performance Report Year 2: 2020–21" (August 31, 2021), https://gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Flexibility/Georgia_Year2APR_August2021.pdf.

[12]U.S. Department of Education, Office of Elementary and Secondary Education, "American Rescue Plan School Emergency Relief State Plans" (January 31, 2022), https://oese.ed.gov/offices/american-rescue-plan/american-rescue-plan-elementary-and-secondary-school-emergency-relief/stateplans.

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while offering innovative opportunities to get students ready for life beyond the standards.

Bonus: The state-level working of the system is so far removed from the general classroom that it is incumbent on state leaders to make extra effort to communicate and network with practitioners. ■

[1]Richard DuFour et al., *Learning by Doing: A Handbook for Professional Learning Communities at Work* (Bloomington, IN: Solution Tree Press, 2013).

[2]Ron Ritchhart, *Creating Cultures of Thinking: The 8 Forces We Must Master to Truly Transform Our Schools* (Jossey-Bass, 2015).

[3]Grant Wiggins and Jay McTighe, *The Understanding by Design Guide to Advanced Concepts in Creating and Reviewing Units* (Alexandria, VA: ASCD, 2012).

cont'd from page 36...Mulling Changes...

(2002): 399–483.

[13]Sheri Stover and Cindra Holland, "Student Resistance to Collaborative Learning," *International Journal for the Scholarship of Teaching and Learning* 12, no. 2 (2018): 8.

[14]Brigid Barron, "When Smart Groups Fail," *The Journal of the Learning Sciences* 12, no. 3 (2003): 307–59.

[15]Jennifer Langer-Osuna, "How Brianna Became Bossy and Kofi Came Out Smart: Understanding the Trajectories of Identity and Engagement for Two Group Leaders in a Project-Based Mathematics Classroom," *Canadian Journal of Science, Mathematics, and Technology Education* 11, no. 3 (2011): 207–25.

[16]Elizabeth G. Cohen and Rachel A. Lotan, *Designing Groupwork: Strategies for the Heterogeneous Classroom*, 3rd edition (New York: Teachers College Press, 2014).

[17]Boaler and Staples, "Creating Mathematical Futures."

[18]Jo Boaler, "Promoting 'Relational Equity' and High Mathematics Achievement through an Innovative Mixed Ability Approach," *British Educational Research Journal* 34, no. 2 (2008): 167–94.

[19]Megan Staples, "Promoting Student Collaboration in a Detracked, Heterogeneous Secondary Mathematics Classroom," in Nasir et al., eds., *Mathematics for Equity.*

[20]Tanya LaMar and Jo Boaler, "The Importance and Emergence of K-12 Data Science," *Phi Delta Kappan*, July 12, 2021.