LITERACY LEADERSHIP

EQUITY AND REPRESENTATION INSTEM

Giving students functional access to 21st-century STEM literacies

By Catherine Saldutti

or over a decade, only 20% of high school graduates in the United States have performed proficiently in science, with students of color ranking in the single digits. Is the science teacher shortage to blame? Is it the lack of science labs and equipment?

Certainly, these factors play a role and can vary in significance from region to region. But after 26 years working in secondary science education, I believe there is one factor we should prioritize. I am convinced these statistics will persist until we provide all middle and high school learners with functional access to 21st-century STEM literacies.

Gaps and unmet needs

ILA's 2018 *What's Hot in Literacy Report* identified gaps and unmet needs in literacy education, which are compounded when considering STEM disciplinary literacy. The report reflected similar findings gathered over the 19 years my firm has worked with 450 public and independent schools in mostly urban settings across the U.S. and internationally. ILA highlighted "gaps and unmet needs," defined as issues that "rank in the top five important topics" but do not receive enough attention.

Teacher preparation showed the largest gap, one that widens greatly for prospective secondary STEM teachers, where coursework on disciplinary literacy is scarce. Many inservice science teachers never received appropriate university training on negotiating technical texts, writing for STEM, or engaging in peer review. Teachers without these experiences avoid them in their secondary classrooms, when texts, concepts, and tasks become more complex.

The ILA report named equity in literacy education as another unmet need, which was echoed in data on STEM education in the 2018 *Condition of College and Career Readiness* national report. A mere 20% of students in 2018 who took the ACT test met the STEM Readiness Benchmark, down from 31% in 2012. Only 2% of underserved students met the benchmark.

The literacy connection? ACT science questions do not require specific science knowledge but rather the interpretation of scientific writing and representations about natural phenomena that students may not have studied. Despite their performance, 45% of 2018 high school graduates declared their desire to pursue STEM majors or occupations. Do they realize they are unprepared?

The same question applies to many university graduates holding STEM degrees. In 2016, PayScale released its *Workforce-Skills Preparedness Report*, highlighting a 37% gap between perceptions of job preparedness held by recent grads and those of the managers who employ them. What three "hard" skills do new graduates lack? Writing proficiency, public speaking, and data analysis.



Catherine Saldutti

(catherine@educhange.com) is the president and founder of EduChange. For over 20 years, she has led teams of educators, designers, researchers, and STEM professionals to completely re-engineer the instructional and assessment systems that power secondary school curricula. Speaking and listening are notably absent from Common Core's 6–12 Standards for Literacy in History/ Social Studies, Science, and Technical Subjects.

And if aspiring engineers think they can depend solely on math skills, Edna Grover-Bisker, director of Career Opportunities and Employer Relations at the Missouri University of Science and Technology, warns against this approach. "Gone are the days of sitting at a cubicle and minding your own business. This is the digital age, and communication skills reign supreme," she professed in 2016.

This is nothing short of a fivealarm fire—and strengthening functional access to STEM literacies must be the first response.

Three access points

In order to provide equitable solutions to this disciplinary literacy crisis, we must consider tangible access, cognitive access, and cultural access to the content and practices of STEM. To give students tangible access, it is imperative that we close the connectivity divide, as all students with devices and wireless access can now enjoy access to authentic STEM content, including educational resources. Delivering real-world STEM to all students is both possible and empowering, and we must engage businesses and governments to ensure this tangible access, particularly in rural areas.

Once the floodgates are open, students must possess the critical literacy strategies that permit cognitive access and eventual comprehension of STEM content. Gone are the days of stand-and-deliver lectures and questions at the end of the textbook chapter. U.S. secondary schools are currently grappling with relatively new adoptions of the Next Generation Science Standards (NGSS) or state science standards, which demand the daily incorporation of science and engineering practices and crosscutting concepts.

The NGSS practices, at their core, are literacy strategies. STEM teachers must now teach students how to leverage conceptual understanding not via memorization but through observation, reasoning, questioning, and generalizing. Students must build conceptual models



and schema, identify pertinent details, and build arguments from evidence. Engaging in verbal and written peer review further deepens comprehension. To understand natural phenomena as well as collected data, STEM literacies must include informal writing-to-learn techniques, writing for metacognition, and writing formally for more purposes than the lab report.

Alongside tangible and cognitive access to STEM literacies, cultural access may prove the most compelling. Students can now learn scientific and engineering concepts through diverse cultural, economic, and geographic case studies that emphasize STEM as multifaceted human endeavors.

Curating the right combination of text types—from data sets to infographics to photo essays to interviews—builds "STEM stories" that powerfully engage even the most reluctant readers, writers, speakers, and listeners. These stories can reach across the globe, with the potential to quite literally connect diverse classrooms studying similar problems (e.g., clean water access, air pollution, cancer clusters). And textbooks must reside in their proper place: as references for specific, decontextualized, technical explanations. Through these approaches, educators can invite a broader cross-section of students to forge their own STEM identities through people, places, and possibilities that leave a lasting impression.

There has never been a more definitive moment to foster functional access to 21st-century STEM literacies in our secondary schools. We simply cannot maintain academic rigor, global relevance, and postsecondary readiness without it.

Increasing equity and representation in STEM depends on our next moves in literacy education.

ILA Intensive: Nevada

Catherine Saldutti will be presenting a session, "Want to Increase Equity and Representation in STEM? Give Students Functional Access to 21st-Century STEM Literacies," at ILA Intensive: Nevada, taking place June 21–22, 2019, in Las Vegas, NV. For more information, visit **literacyworldwide.org/** nevada.