A New Vision for Science, Technology and Engineering, and Environmental Literacy and Sustainability Education in Pennsylvania

The Science, Technology & Engineering, Environmental Literacy & Sustainability (STEELS) Standards reflect decades of research and advances in teaching and learning. To equip students to think critically, analyze information, and solve complex problems, the standards are arranged such that — from elementary through high school — students have multiple opportunities to deepen knowledge and skills by building upon important concepts and expanding their understanding of connections across the STEELS subjects.

Why Did Pennsylvania Adopt the STEELS Standards?

The STEELS Standards are rigorous learning goals that will help prepare students for college, careers, and citizenship. While standards alone will not improve student outcomes, they are the essential foundation for other important local decisions about curriculum, instructional programs, assessments, and school policies.

It has been 20 years since Pennsylvania's standards in these areas were revised. Since that time, many advances have occurred in the STEELS fields, as well as in the innovation-driven economy. The STEELS Standards reflect important advances in science, technology, engineering, environmental literacy, sustainability, and science.

The STEELS Standards were developed based on research about how students learn best. The STEELS Standards indicate an instructional shift, not just a shift in what is taught and learned, but also how it is taught and learned.

Why is this Instructional Shift Important for Students?

Education research is clear that this approach to teaching will not only improve student engagement and interest, but also that students learn and retain knowledge best this way. This is especially true for students from communities or backgrounds that are often underrepresented in STEELS fields.

The STEELS Standards represent a shift from "learning about" to "figuring out" that puts students in the driver's seat.

- **Students actively learn through meaningful investigation and design.** These K–12 standards represent a significant shift away from rote memorization and heavy reliance on learning by reading the textbook to greater student ownership of their own learning focused on explaining real-world phenomena and solving meaningful problems. Thus, the STEELS Standards represent a shift in both the *how* and the *what* of teaching and learning.
- **Students learn content while engaging in science, technology, and engineering practices and applying them to the local environment and the world around them.** Every STEELS Standard has knowledge and practice components, reflecting how these fields are practiced in the real world, leading to deeper learning. Over time, students will view these disciplines as interrelated fields of investigation and design that help them make sense of and enhance their communities and the world.
- **The STEELS Standards are unique to Pennsylvania.** The learning goals ask Pennsylvania students to not only focus on the natural sciences, but also technology and engineering as well as environmental literacy and sustainability.

Example Instructional Shift

Learning through rote memorization and tasks
Students learn how producers differ from consumers and create a model of a food web with no connection to a real-world example.

Learning through real-world phenomena
Students create a model to explain what effect cutting many of Pennsylvania's large forests in the early 1900s had on the recovery of the local deer population.

How will Education Change with Pennsylvania's STEELS Standards?

Science, Technology and Engineering, and Environmental Literacy and Sustainability Education Will...

Focus less on	Focus more on
Rote memorization of facts and terminology.	Facts and terminology incorporated as needed while developing explanations and describing solutions supported by evidence-based arguments and reasoning.
Learning of ideas disconnected from student questions and applications to real-world scenarios.	Defining and modeling a system and its boundaries to help explain phenomena and to give a context for the ideas to be learned.
Learning life, physical, and Earth and space science mostly in isolation.	Instruction highlights the interconnectedness of scientific, technological, engineering, and environmental focused study.
Teachers providing information to the whole class through direct instruction.	Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance.
Teachers posing questions with only one right answer.	Students discussing open-ended questions that focus on the strength of the evidence used to generate claims.
Students reading textbooks and answering questions at the end of the chapter.	Students reading multiple sources, including science-related magazines, journal articles, and web-based resources; students developing summaries of information.
Pre-planned outcome for "cookbook" laboratories or hands-on activities.	Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas.
Worksheets.	Students developing journals, reports, posters, media presentations, projects, and models that explain causes of phenomena and/or argue based on evidence to defend a new idea or explanation.
Oversimplification of activities for students who are perceived to be less able to do science and engineering.	Providing supports so that all students can engage in sophisticated science, technology, and engineering practices.

The table above is adapted with permission from: National Research Council. (2015). *Guide to implementing the Next Generation Science Standards*. The National Academies Press. https://doi.org/10.17226/18802

To learn more about the STEELS Standards, visit the Pennsylvania Department of Education STEELS Hub on SAS: https://www.pdesas.org/Page/Viewer/ViewPage/58