Next Generation Science Standards & Afterschool

Standards Across the States

The Common Core State Standards (CCCS) in English Language Arts (ELA) and Mathematics were designed to provide a consistent, clear understanding of what students are expected to learn across schools and state borders.[1] In addition to providing consistent messages across educational institutions, these academic standards allow teachers, families, and out-of-school time providers to share a common language and set of expectations when discussing the academic goals for Rhode Island youth.

The Next Generation Science Standards (NGSS), currently in development, are the science standards that will compliment the CCCS in ELA and math. The National Research Council (NRC), the staff arm of the National Academy of Sciences, began the NGSS process by developing the "Framework for K-12 Science Education."[2] The Framework is grounded in the most current research on science and science learning and identifies the science that all K-12 students should know.[3] Once the Framework was established, with input from four design teams (in physical science, life science, earth/space science, and engineering) a public draft was released for comment and feedback. The NRC reviewed and incorporated feedback as necessary before releasing a public draft of the final Framework in July of 2011. This final draft was then used by a delegation of states (including Rhode Island) brought together by Achieve Inc. (the leading advocacy organization for standards-based reform of the nation's primary and secondary education system[4]) to lead the development of K-12 science standards.

The goal of the NGSS is to provide all students an internationally-benchmarked science education that is rich in content and practice, and arranged in a coherent manner across disciplines and grades.[5] In order to achieve this on a deep and meaningful level, Achieve Inc. and participating states are working with stakeholders in science, science education, higher education, and industry with additional review and guidance provided by advisory committees composed of nationally-recognized leaders in science and science education as well as business and industry.[6] The review process also includes two public drafts, the second of which was available through January 29, 2013, with an expected release of the NGSS in the spring of 2013.

Practices of Science and Engineering

In providing the basis for the NGSS, the Framework identifies some disciplinary core ideas that students should learn with increasing depth and sophistication from kindergarten through grade twelve.[7] These ideas mark what might be the most significant departure from prior science standard guidelines, namely that student assessments will not assess students' understanding of core ideas separately from their abilities to use the *practices* of science and engineering.[8] As such, the Framework identifies 8 practices it believes are essential for all students.

The Eight Practices of Science and Engineering

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

All students in grades K-12 should engage in these

practices throughout their K-12 education, and students' abilities to use the practices should grow as they progress in their education. The practices are a method of engaging in scientific exploration, not a prescribed teaching method or curriculum. As such educators should use the practices as a guideline for what students are able to do rather than an outline of how science should be taught. The practices are designed to connect with each other and to overlap; one might flow into the next and then wrap back around itself to bring a student back to the original practice. Just as educators should work with students to make sure they understand and engage in all eight practices, they should also be helping students see the interconnectedness among them.

Practices Matrix

The practices matrix provides a great point of access to begin working with the NGSS. While both the practices matrix and the NGSS themselves are still in development, looking at the latest draft of the practices matrix provides a basis for understanding how the Framework and the NGSS believe students and educators should approach science throughout the grades. The matrix is organized by the practices, with eight matrixes (each one focusing on a different practice) divided by grade levels (K-2, 3-5, 6-8, 9-12). Each matrix is preceded by a comprehensive explanation of the practice, including examples of how the practice differs in science vs. engineering. Looking at the matrix itself as a continuum an educator can see how a practice develops through the grade bands.

Crosscutting Concepts

In the same vein as the science and engineering practices, the Framework identifies seven crosscutting concepts meant to give students an organizational structure to the world and help make sense of and connections between core ideas across discipline and grade bands.[9]

Crosscutting Concepts

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter in Systems
6. Structure and Function
7. Stability and Change of Systems

Similar to the science and engineering practices, the crosscutting concepts are not designed with specific grade-band endpoints, but instead follow a continuum that may lead students a to certain understanding of the concepts by the end of grade twelve after following a progression of comprehension throughout their education.

Crosscutting Concepts Matrix

The crosscutting concepts matrix can be used in conjunction with the practices matrix to support educators in using the NGSS after they are released in the spring of 2013. It can also be used on its own as a way of looking at the world scientifically; looking for the concepts in everyday life and daily activities is a way of looking at the world through a scientific lens.

Slightly different from the practices matrix, the crosscutting concepts are explained in two sections. The first section is a description of how the crosscutting concepts can be used in each grade band separated by individual concepts with examples given for the three areas of science (Life Science, Physical Science, and Earth and Space Science) that compromise the NGSS. The second section is a matrix that gives a brief description of each concept, followed by a continuum of how the concepts might develop across the grade bands.

Next Steps

Once the final draft of the NGSS is released in March of 2013 educators across the country will be able to access the standards at www.nextgenscience.org and begin to use them in their work with students in grades K-12. RIASPA will announce the release of the standards to all of its members, and will continue to make connections with science educators both formal and informal across the state in order to support the integration of STEM in out-of-school time programming.

References

[1]http://www.corestandards.org/
[2]www.nextgenscience.org/development-overview
[3]www.nap.edu/catalog.php?record_id=13165
[4]http://www.education-first.com/our-clients/achieve-inc
[5]http://www.nextgenscience.org/development-overview
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[8]http://www.nextgenscience.org/sites/ngss/files/Appendix%20F_Science%20%20Engineering%20Practice%20-%20FINAL.pdf
[9]http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20in%20the%20NGSS%20-%20FINAL_0.pdf

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RIASPA Staff

- Adam Greenman
  Executive Director