Three Questions From a Town Hall Meeting About the NGSS

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As a former school district Science and Mathematics Coordinator, and a current K–5 science author for McGraw-Hill Education, I, along with my education colleagues, am very excited about the Next Generation Science Standards (NGSS), and look forward to their implementation in classrooms across the country.

Several months after the release of the final NGSS, there was a Town Hall meeting at a local County Office of Education, which focused on the NGSS. Three of the key questions and comments raised at the meeting appear below, followed by consensus answers from the meeting, incorporating my analysis. The focus of these Q and A's is on K–5, but may be extrapolated to higher grade levels.

Question 1

The format of the performance expectations (PE's) in the NGSS is complex, including the integration of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts, as well as connections to the Common Core State Standards (CCSS) for mathematics and English language arts (ELA). **How will teachers be able to translate the PE's into curriculum, classroom instruction, and assessment?**

Answer: The NGSS performance expectations are not intended to be or to prescribe a science curriculum. However, along with the National Research Council's *A Framework for K–12 Science Education,* the PE's will provide guidance to local, state, and national curriculum developers, publishers, and assessment groups, as they develop grade-level scope and sequences, learning progressions, and curriculum units, incorporating instructional strategies and assessments consistent with the PE's in the NGSS.

Along with these resources, there will need to be extensive professional development on the NGSS, which will be provided by local districts, County Offices of Education, state-wide science organizations, State Departments of Education, and publishers.

Until NGSS-based curricula are developed, adopted, and implemented, along with the appropriate professional development, teachers can experiment with the "Less is More" approach emphasized in the NGSS. This means that teachers should teach fewer science concepts, teach the concepts in more depth, integrate math and English language arts into science instruction (and vice versa), and focus on providing direct experiences with the Science and Engineering Practices.

Question 2

Elementary school teachers are in the midst of learning and implementing the Common Core State Standards in mathematics and English language arts, in addition to preparing for new and more in-depth forms of assessment, such as those provided by the Smarter Balanced Assessment Consortium and the Partnership for Assessment of Readiness for College and Careers. **Will teachers suffer from "reform fatigue" if the NGSS are introduced at the same time?**

Answer: Elementary school educators, who are responsible for teaching multiple subjects, have already begun implementing the CCSS, and can incorporate the NGSS, since the standards in each area have commonalities in format and content. The NGSS cite specific Common Core standards in math and ELA that are connected to each Performance Expectation in science. Likewise, science can and should be incorporated into many math and literacy lessons, e.g. graphing data obtained from inquiry-based science activities, and reading and responding to content-rich science texts.

At the elementary level, in the future, there might be fewer single-discipline subject matter lessons in math, ELA, or science, since these three areas of the curriculum will be integrated, as students meet the CCSS and the NGSS. This will mirror how science and engineering design are actually done. During the course of scientific investigations and engineering design work, both mathematics and English language arts practices are used to analyze, structure, and communicate findings and results, both orally and in writing.

Question 3

The NGSS include a major focus on engineering and engineering practices, along with science. **Why is there such an emphasis on engineering, and where are science process skills, inquiry learning, and the scientific method in the NGSS? Will Science Fairs still "fit" in the curriculum?**

Answer: In the NGSS, engineering design is raised to the same level of significance as scientific inquiry at all grade levels. The integration of science and engineering reflects the way scientific research and engineering design occur in the "real world." Increasingly, there is collaboration across and within traditional scientific disciplines, and research teams may include cross-disciplinary scientists, statisticians, computer scientists, engineers, and others. It is hoped that the

inclusion and integration of engineering design with science education will increase student understanding of and interest in STEM fields.

In the introduction to the NGSS, the rationale for using the term *science and engineering practices* instead of *science process skills,* focuses on students directly engaging in the practices during scientific investigations, including the knowledge involved in each practice, as specified in the PE's and learning progressions. Science process skills such as classification, measurement, prediction, and identifying variables are still important, but should not be learned as isolated skills. Rather, these processes may be directly taught and used within the higher level science and engineering practices, as identified in the NGSS.

As for "inquiry," the NGSS portray an inquiry-based approach to science, and are intended to better specify what is meant by inquiry, which has been interpreted in a variety of ways by science educators. Regarding the "scientific method," it has long been thought that there is no single step-by-step method that is used by all scientists, such as: make observations, ask a question, form a hypothesis, test the hypothesis, analyze results, and draw conclusions. Scientists and engineers use a more recursive series of practices, which may occur in varying order and degree, as they study the natural world or solve engineering design problems.

Lastly, yes, there is a place for Science Fairs in NGSS-based science curriculum and instruction! Students who create science fair projects, including engineering design and invention projects, will be able, over the course of their K–5 science program, to directly experience all of the science and engineering practices as described in the NGSS, as well as the relevant Common Core State Standards in math and ELA. Teachers of primary grade students may wish to begin with class science and/or engineering design projects, and progress through the grades to individual student projects, leading to school and/or district science and engineering fairs. When correlated with the appropriate Disciplinary Core Ideas and Crosscutting Concepts, the development of such projects provides a rich context for the practices of science learning and engineering design.