

The Final Push for Revised Massachusetts Science and Technology/Engineering Standards

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Now that the Next Generation Science Standards (NGSS) are done and available for states to consider we need to consider what will work for us here in Massachusetts. This article takes a moment to reflect on the Massachusetts Science and Technology/Engineering (STE) standards revision process to date and what steps are likely remaining before we can adopt revised standards.

Many of you recall that the revision of STE standards started in 2009. At that time we asked for input from the field about the current (2001/2006) standards – what could be improved and what should be protected. We also put together a 35+ Review Panel that is representative of the many roles and positions that contribute to science and technology/engineering education across the state. The Review Panel spent about a year and a half determining what broad changes should be made to the STE standards (www.doe.mass.edu/boe/docs/0111/

Working together on the implementation of revised STE standards will provide a more systemic, cohesive and effective experience for all students.

item2.html) and began to revise the standards. Before the actual revisions got too far, however, the National Research Council (NRC) and the 26 Lead States for the NGSS began the multi-state science standards development process. Massachusetts participated in the NGSS process over the past two years, using input from Massachusetts' educators, Review Panel members and an expanded advisory group to advocate for standards we

believe include the features needed in high quality, effective standards.

The final version of the NGSS represents several important changes that we value here in Massachusetts; these values have emerged and been reinforced through the work of our Review Panel and input from numerous educators across Massachusetts over the past three years. These changes include: 1. Integration of disciplinary core ideas (content) with science and engineering practices (the 8 skill areas presented in the NRC's Framework for K-12 Science Education); 2. Attention to progressions of learning across years to effectively sequence learning over time; 3. Connections to math and literacy standards, particularly as represented in the science and engineering practices; and 4. Integration of engineering design with the traditional sciences. I've written about a few of these changes in prior MASThead articles. We will all need to work together to develop resources, adjust our curriculum and instructional practice, and help students to make the transitions reflected in these changes. Many of you have already begun this work – most frequently by attending to

the practices and connections to math and literacy standards. Thank you for being proactive and moving your work forward even as the standards continue to be developed.

While the NGSS reflects significant progress toward high quality STE standards and key goals for Massachusetts' students there are several significant differences between NGSS and our current standards that still need to be considered. Through

input from educators across the state during the past three years we have heard that these aspects of NGSS may be difficult to adopt and implement in Massachusetts: 1. Standards that reflect four dimensions of expected student outcomes (content, practices, crosscutting concepts, and nature of science); 2. Lack of a definition of college and career readiness for science and engineering; 3. Lack of high school courses or pathways that allow for multiple options for schools and students; and 4. Lack of a full technology/engineering discipline.

Our current standards are functionally 1-dimensional; they focus on the content of each discipline to be learned. While they are written as performance expectations, with a verb that describes the expected student performance relative to the content, those verbs are general cognitive verbs (Bloom's taxonomy verbs) and not scientific skills. In 2006 when the high school standards underwent a "minor" revision to clarify expectations for the high stakes test (addition of science to the state's Competency Determination), several standards focused on skills were added but left very general and still separate from content. Most who have provided input over the past 3 years agree that integration of content and practices (2 dimensions) is a worthy goal and if achieved would represent a significant accomplishment. Trying to include additional dimensions above that is likely to lead to confusing and dense standards that would not effectively convey clear and coherent science goals.

A definition of college and career readiness (CCR) and high school courses and pathways are linked

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items. The NGSS does not define CCR but does advocate for all students to learn all the NGSS high school standards, effectively defining three years of science that all students would take. This is a very different model from our current approach to high school where 5 different "introductory" (gr. 9 or 10) courses are articulated, from which schools can choose from and build upon at upper grades to provide students many options for pathways through science. Additionally, Massachusetts continues to value and strongly support STEM education and a STEM economy; as such we will continue to include and advance technology/engineering with the traditional sciences. These are significant differences between NGSS and our current standards that reflect different conceptions of what it means to be ready for college and career opportunities after high school.

It is important to note that Massachusetts is committed to using the NGSS as a basis for any additional work in revising our state's STE standards. We have to keep in mind the value of common standards for us all – particularly as a small state for which little published curricula, textbooks or instructional resources are developed in direct alignment to Massachusetts' standards. Having standards that are common to other states will allow each of us to find such resources developed around the country without having to adapt them to fit our unique standards. So there are clear benefits to common standards. However, we will not adopt standards that we do not feel reflect clear, coherent, and rigorous expectations that we can all implement effectively. So some adjustments of the NGSS are necessary before Massachusetts can adopt revised STE standards. The particular nature and scope of the adjustments are is what the next several months will help us determine.

Work on these remaining issues will move along relatively quickly. We already have input from many educators about these issues and received or developed a number of suggested strategies to address each. Over the next several months our STE Review Panel

and expanded advisory group will be providing recommendations about particular actions. They will also assist in the refinement or revision of standards to reflect those actions. The goal is to have a draft set of revised STE standards for public consideration and comment by this coming fall. Once that draft is available significant time will be provided for all Massachusetts educators to review and provide additional input. This input will be used to make final adjustments and edits before the standards are adopted by the state Board of Education, ideally in the winter (about mid-school year).

There are a couple of things that are helpful to keep in mind as you consider what it will take to implement revised STE standards. First, the science and engineering practices are about student outcomes—the skills students are to learn and be able to do; they are not about instruction per se. The practices are skills students are to have learned as a result of instruction. Instruction of particular concepts does not have to be limited to or constrained by the practices included in the standard. Second, an emphasis on progressions of learning highlights the importance of student experience and learning of standards at all grades. We cannot assume that students can arrive in 5th grade, or middle school, with little science instruction through elementary grades and expect to succeed without significant remediation. And third, there are several statewide initiatives underway that provide opportunities to advance



the implementation of new STE standards and their key features. Both the goal setting and personal professional development components of the new educator evaluation system provide a systemic way to highlight and get support for the changes that will be called for. Through this process districts and schools will also be creating (ideally in collaboration with other districts and schools) district-determined measures that should emphasize demonstrations of science and engineering skills and knowledge all students should achieve. Please help each other advance this work and make effective use of these opportunities. The Department will also be looking to provide examples and support for this work over the next several years. Working together on the implementation of revised STE standards will provide a more systemic, cohesive and effective experience for all students.

We are in the final phases of the STE standards revision process. Please check the revision page for periodic updates on next steps (www.doe.mass.edu/omste/review.html). We will soon have a comprehensive set of revised Massachusetts STE standards that we can all comment on, that we can rally around, and that we can engage our students in. ☀