Dear Maine DOE Science and Technology Learning Standards Review Team,

I would like to offer the following public comment for the current Science and Technology standards that under review.

I am beginning my 32nd year as a high school science teacher. I also currently serve as a teacher leader in number of roles within the state and the nation. I am a 2017 National STEM Ambassador and chair the Teacher’s Advisory Council for the National Academy of Sciences. I am Nationally Board Certified and have many honors and awards to my name. I tell you this because I have been deeply involved and extremely privileged with a wide variety of opportunities and experience in science education for over three decades. My perspective and thoughts reflect this experience.

It is my deepest belief that we need to move away from the current parameter of essential instruction and adopt the Next Generation Science Standards (NGSS). There are many reasons to support this and I provide several of these reasons below.

1. These standards were based on the National Academy of Science’s Framework for k-12 Science Education. The framework is a synthesized study of the state of knowledge in science education and pedagogical content knowledge. Teams of educators, scientists and other stakeholders committed to world-class science education wrote the standards themselves. Maine was among the states that reviewed the various drafts. So these are standards that we have already been a part of the process.

2. Over 70% of school districts across Maine have adopted NGSS or a slight variation for their proficiency based diploma. Two points to make about this. The first is any standards adopted for the state that are different than NGSS will add stress and work to already thinly stretched school districts that have spent years creating, piloting and implementing their proficiency plans. The second is that if NGSS were adopted across the state we can build capacity to support all teachers in a common direction. Currently there is very little sharing, collaborating and growing between school districts because of big differences in the science standards from school to school.

3. Most teachers support NGSS as standards. When you talk to teachers the concerns arise around implementation. One area of concern is that some schools have adopted NGSS without training to support learning that is different with NGSS. We have some exciting models that can be used to help support teacher PD but currently some of the most promising PD programs for NGSS are too expensive. If we had schools across the state the PD becomes much more affordable.

4. Networks of fully vetted learning and assessment materials are available to teachers. These allow teachers to provide relevant, current lessons at no cost to school districts.

5. There is a focus on science practices vs. inquire or the scientific method. The scientific method as taught through the last few decades gave students the perception that science is very formulaic. It is not. Instead the practices outlined in the NGSS focus on are the areas within the discipline of science that are essential skills and knowledge. Each practice has a progression of learning so we
can work k-12 and then intertwining multiple practices so students experience the scientific endeavor. The nature of science is complex but we want all students to build scientific reasoning skills. The practices provide more explicit understanding of how science works and an understanding of the nature of science.

6. There is a perception, among some, there are watered down standards in chemistry and physics. A physicist colleague offers this perspective.

**Concern:** There are physical science content omissions, such as, Newton’s first law, energy, thermodynamics, Ohm’s law, simple electrical circuits and lab safety.

“Newton’s first law is simply one specific case of how force, mass and acceleration are related – specifically, the case where acceleration is equal to zero. The more universal law – which covers the same relationship at all accelerations (both zero and non-zero accelerations) is Newton’s Second Law. Newton’s Second Law is explicitly covered in HSPS2-1. There is no physics teacher that I know of that would interpret HSPS-1 in a way that would exclude zero acceleration situations.

Energy is, in fact, an entire standard (HS-PS3), including five very complex performance expectations that require students to understand the relationships between and among the various modes of energy, how changes in a system affect the energy modes and flows within the system, and utilizing energy modes and transfers within the engineering design process.

The Second Law of Thermodynamics is explicitly covered in HS-PS3-4.

Ohm’s Law and simple electrical circuits are not explicitly written into the standards, but there are specific references to electrical energy throughout the document. Additionally, it is important to note that the NGSS standards are the minimum expectations of all students – not the sum total of everything that can or will be taught to students.”

7. There is a strong alignment of NGSS with CCSS math & ELA standards NGSS at all grade levels. We know that teachers need to talk across content areas and this crosswalk between NGSS and CCSS opens conversations. In addition, if we compare NGSS to our current parameters of essential instruction we see a much greater emphasis in the practices for mathematical thinking and reasoning. Work at the RISE center, UMO and Maine Data Literacy Project has closely aligned the NGSS practices with CCSS in mathematics.

8. Job forecasts over the next 10-15 years shows almost 0% growth in the general job market but a 6% rate of growth in STEM jobs in our state. If you look at states that have adopted NGSS they have a stronger STEM force to meet growing job demands compared to states that have not adopted. Source: [http://vitalsigns.changetheequation.org](http://vitalsigns.changetheequation.org)

9. NGSS puts earth and space sciences on the map of important content area. Some of our most urgent problems are based in these disciplines. We want all citizens to have a solid foundation of understanding so they can make informed choices about their future.
These are a few of the reasons why I hope that we as a state will adopt NGSS as a result of our review process. The current standards, better than the purple book, are not the well-articulated standards that NGSS is. We are a small state with limited capacity. Why wouldn’t we take advantage of the vast knowledge base and resources that are building within the NGSS community?

Thank you for considering my thoughts!

Sincerely,

Margo Murphy

Rockport, Maine

2017 STEM Ambassador

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