To: Commissioner Makin and Beth Lambert, Maine Department of Education
From: Dr. Ruth Kermish-Allen, Dr. Katahdin Cook Whitt, Shari Templeton, Adrienne Hanson, Leonard Kenyon, Dr. Lisa Kenyon, Maranda Chung
RE: Comments on the Science and Engineering Standards Review

Collaborative comments of the MMSA science education team & executive director of the Maine Mathematics and Science Alliance (MMSA) submitting testimony in response to the department's request for comments on the Science Standards Review.

Dear Commissioner Makin and Ms. Lambert,

As current staff members of the Maine Mathematics and Science Alliance, or MMSA, we would like to express our support for the current science and engineering standards in Maine. MMSA works with more than 1000 educators each year, and we have been encouraged by those educators to submit comments to inform this standards review process. We have encouraged each of these educators also to provide comments to the Department of Education.

We are extremely pleased to see the education department emphasizing the standards revision process this year. Regularly reviewing and revising our learning standards ensures that our students are reaping the benefits from the most recent research findings and best practices in education.

As this review begins, we want to shine a light on the critical role Maine educators played in the development of these science standards. In 2011, Maine was selected to be one of twenty-six Lead State Partners in the development of the Next Generation Science Standards (NGSS, 2013) based on the National Research Council's *Framework for K-12 Science Education* (2012). Maine educators collaborated with critical partners, including the National Research Council, the National Science Teachers Association, and the American Association for the Advancement of Science in this process. Teachers from Maine were heavily invested in the development of NGSS, representing the 3rd highest per capita involvement of any of the 25 other lead states. During the 2018 standards review cycle, educators from Maine played a critical role in bringing together Maine-specific phenomena to use as examples paired with NGSS performance expectations,, but were otherwise very pleased with the standards as written.

For any members of the committee who are not familiar with these standards, the NGSS are a research-based set of 3-dimensional standards (including cross-cutting concepts, core disciplinary ideas, and scientific and engineering practices). The NGSS are designed to help students understand and experience "doing science" while simultaneously constructing deep conceptual understanding of core

science ideas. The NGSS enable students to realize that science is much more than a set of facts; it is an opportunity to discover how our world works and how we can participate in designing solutions for our shared future. The NGSS are written so that by the end of high school, students should have developed a deep and sophisticated understanding of science ideas, concepts, and practices to help them become critical consumers of scientific information, thoughtful citizens, and productive employees both within and outside of STEM fields.

In our conversations with educators across Maine, they ask that this revision process stay the course of the current science standards, which are adopted from the NGSS. This new version of the science standards for Maine only came into being a short time prior to the beginning of the pandemic. Even with the best intentions, pandemic-era education was very difficult for every educator and student. Given COVID restrictions, many educators were not able to utilize the full impact of their teaching practice. Their energy was spent on keeping children safe and healthy, not on realizing the vision of Maine's new science learning results.

Districts have just begun finding methods to integrate the standards and science practices into their classrooms. Only in the past year have we seen these reform initiatives start to bear fruit. Research in educational change suggests that change initiatives take time and focused attention, and educators in Maine are only just beginning this journey. Only after multiple years of implementation will our state have any supporting data to inform a standards revision process. **We encourage you to give educators time to make these changes happen and to follow through on the very beginning initiatives.**

If we were to change tact on these standards now, much of the work that our districts have done would lose momentum on the advances to realizing the significant shifts to classroom instructional practice called for by the *Framework* and NGSS. Further, in a climate where we are already experiencing teacher shortages, the impact on teachers would be substantial if they were asked to make yet another set of major changes without having had the opportunity to see through the current initiative. We anticipate that this would lead to distrust and frustration on the part of teachers, schools, and districts.

Thank you for your commitment to ensuring that Maine's science learning results are as strong as they possibly can be. With more time to see these learning innovations truly take root in our classrooms, we will all begin to reap the benefits. Our young people will be able to think critically, use data to inform their decision making, and have the ability to collaborate with individuals and groups that have different perspectives than themselves. Please keep Maine's science learning results as is, without changes, to provide Maine's educators with the time they need to make the significant shifts in their practice and classrooms.

As an educator of nearly 20 years and a mother of two school aged children I would like to express my support for continuing to use the Next Generation Science Standards as the state of Maine's adopted standards. They are complex, but flexible, focus on the practices and cross cutting concepts of science and engineering and still contain content that is foundational for our students to know.

Full adoption of these standards are still ongoing in many places and much effort has been put into learning how to implement them effectively. Professional development around implementation of the NGSS needs to be stronger and more available and it would be helpful to have a content specialist in science that could assist districts with this.

I recommend that we stay the course with the NGSS as they are. The standards were built on a solid framework of what skills and knowledge will be useful to our students as they become fully functioning citizens of the world. A strong science and engineering background helps prepare our youth to make informed decisions about their own lives and informed decisions that can, and do, impact others.

Thank you for your time.

Sincerely,

Alyson Saunders
Science Teacher
Dexter Regional High School
asaunders@aos94.org

March 23, 2023

Maine Department of Education:

My name is Brooke Teller and I have been a teacher for 26 years, the past 16 in the Portland Public Schools. After 11 years at Casco Bay HS, a time during which I was named the 2017 Cumberland County Teacher of the Year, I moved into a district wide STEM Teacher-Leader position.

Maine educators only recently adopted our current set of standards. As an educator for Maine students, I strongly feel this current review should be for egregious errors only. None have been found in the standards. With the fairly recent development of aligned instruction materials, any major shifts would cause a reset to the work that has been done thus far. I remain confident that this set of standards, well implemented, is accurate, correct, and vital for a strong, research-based science education for all Maine students. My current work as a Teacher-Leader in Portland, working specifically on our elementary science curriculum, has been closely aligned to the current Maine Science Standards. Significant investments have been made to ensure that teachers and students are provided high quality, standards aligned curriculum. For the State to make any significant changes now would erode the important curricular work we have been doing, not to mention the financial impact.

It would be extremely beneficial if there was state-wide professional development on understanding and implementing the high-quality science instruction that these standards promote. This has not been provided since the Framework was introduced. Assessments (state, district, and classroom) that are aligned with the three dimensions, are needed and must mirror instruction. In addition, I urge that the MDOE hire and support at least one science education content specialist.

Finally, I also urge that regional science education leadership collaboratives that are rich in teacher leaders, school administrators, higher education faculty, and NGO representatives be established to support and advocate for science learning by all Maine students.

Thank you,

Brooke Teller, telleb@portlandschools.org

STEM Coordinator, Teacher-Leader

Portland Public Schools

353 Cumberland Ave

Portland, ME 04101

To the standards committee,

I am a middle school science teacher and department head, and have worked for the past eleven years to clarify and create coherent units for our middle level students at grades 7 and 8, and also work with our 6th grade teachers at the elementary schools in our vast district to distribute the targets and units to allow for best use of materials, expertise and budget needs. The Next Generation Science Standards are at the core of this work, and I hope we continue to use these standards as our benchmark and assessment target across elementary, middle and high school level at the state level with no changes.
These standards are research based and provide students and teachers with high quality science practices and cross cutting concepts to allow all students to explore science in an applicable and genuine way. I appreciate all the professional development I have accessed to help me understand these standards and then be able to teach my department and students using the deep knowledge base, practices and concepts imbedded within each standard.

I hope you will continue to keep the standards work as is and allow teachers to continue to hone their knowledge and skills within the framework presented nationally and recently adopted by the state of Maine.

Thank you,
Mrs. Cameron Sutton, MS Ed
Oxford Hills Middle School
South Paris, Maine

My name is Catie Wooten and I have been a teacher for 17 years at Yarmouth High School. I am writing today to encourage Maine to continue with the progress we are making using our current set of standards. I currently work on a district-level curriculum review; we feel that the standards are strong and the best markposts for science instruction. We also are continuing the process of ensuring that our instructional materials and assessments help students meet these standards. The standards are providing us with what we know is the best approach to science teaching. We also know that to do it well, we need support, training, and time to get it right. Our students are learning science in new ways, and it takes time to develop the materials, instructional techniques and skills to maximize student learning.

Maine educators only recently adopted our current set of standards. As an educator for Maine students, I strongly feel this current review should be for egregious errors only. None have been found in the standards. With the fairly recent development of aligned instruction materials, any major shifts would cause a reset to the work that has been done thus far. I remain confident that this set of standards, well implemented, is accurate, correct, and vital for a strong, research-based science education for all Maine students.

It would be extremely beneficial if there was state-wide professional development on understanding and implementing the high-quality science instruction that these standards promote. This has not been provided since the Framework was introduced. Assessments (state, district, and classroom) that are aligned with the three dimensions, are needed and must mirror instruction. The current state assessment for juniors is not aligned. In addition, I urge that the MDOE hire and support at least one science education content specialist.

Finally, I also urge that regional science education leadership collaboratives that are rich in teacher leaders, school administrators, higher education faculty, and NGO representatives be established to support and advocate for science learning by all Maine students.

Thank you,

Catie Wooten

Science Teacher

Yarmouth High School

207-846-5535

Hi Beth
Mike McKernan reminded me that the Maine DoE is currently evaluating the Science and Engineering standards and that today is the deadline for comments.

I attach here comments on three of the High School level, Life Science standards. The comments reflect what we here at JAX have learned from working with over 85 Maine HS teachers over the last 8 years and from rapidly emerging knowledge from the fields of human genetics and genomics. We have done evaluations of teacher genetics knowledge, students learning gains in genetics and students attitudes about genetics/genomics and STEM careers and have gotten significant feedback over these years from teachers.

My attachments have the Maine standards downloaded from the DoE site, with just a few comments in italics in the text, marked as *Comments Wray Jackson Lab*.
I hope these comments are valuable and not off target.

Best
Charlie

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HS-LS1 From Molecules to Organisms: Structures and Processes

HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Further explanation: Emphasis is on protein synthesis from DNA to codon to amino acid sequence.

Constructing Explanations and Designing Solutions, Structure and Function, Structure and Function

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Further explanation: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system. Another example could be the water and nutrient intake in soft shell clams.

Developing and Using Models, Structure and Function, Systems and System Models

Comments (Wray Jackson Lab): *Not sure why emphasis is on organism level. There are hierarchical levels across biology, many having important emergent properties at each hierarchical level. If the standards can focus on Protein to cell to tissue to physiological system properties, then you can tie this standard well to HS-LS1-3 on homeostatic mechanisms.*

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Further explanation: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels. Another example is commonly observed in the daphnia heart rate response to changes in temperature, caffeine, alcohol, or nicotine.

Planning and Carrying out Investigations, Structure and Function, Stability and Change

HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Developing and Using Models, Growth and Development of Organisms, Systems and System Models

Comments (Wray Jackson Lab): *The standards should include reference to differences in gene expression and subsequent differences in protein/enzyme etc. content in cells. Gene expression and different levels of proteins drive differentiation in cell lineages. This is an important phenomenon that does not appear in the standards.*

HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

Further explanation: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models. Models may focus on Maine based economy of photosynthetic organisms such as seaweeds, potatoes and pine trees.

Developing and Using Models, Organization for Matter and Energy flow in Organisms, Energy and Matter

HS-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Further explanation: Emphasis is on using evidence from models and simulations to support explanations.

Constructing Explanations and Designing Solutions, Organization for Matter and energy Flow in Organisms, Energy and Matter

Comments (Wray Jackson Lab): On Organization of matter and energy flow, Shouldn't this also reiterate the information exchange system (DNA-RNA-Protein) not just the organization of matter?

HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

Further explanation: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration. An example could be a moose eating a lily pad, the lily pad producing energy for the moose and the breathing of oxygen by the moose to enable the process of cellular respiration.

Developing and Using Models, Organization for Matter and Energy Flow in Organisms, Energy and Matter

HS-LS3 Heredity: Inheritance and Variation of Traits

HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring

Further explanation: Emphasis is on the asking of clarifying questions about the general principles of genetics. An example is how cystic fibrosis (one of the most common autosomal recessive inherited diseases in Maine) is passed from parents to child.

Asking Questions and Defining Problems, Structure and Function, Inheritance of Traits, Cause and Effect

Comments (Wray Jackson Lab): *Published national data suggests that HS life science needs to expand from a one gene to one trait relationship. The cystic fibrosis explanation example is solid but reinforces the one gene-one protein-one disease line of reasoning. The CF gene (CFTR) has >10,000 DNA variants leading to a wide range of 100% neutral to very clinically pathogenic consequences. Further most diseases, including common disease such as diabetes and cancer are driven by many genes. So, it is important to have standards that: include explanation of polygenic characteristics (disease or regular characteristics such as height/stature), highlight genetic variation as extensive, complex, and leading to wide ranges or regular characteristics and health related outcomes (disease severity, differential immunity, longevity, etc,).*

In our work across >80 high schools and with 85 teachers in Maine it is somewhat common to have students and a small number of teachers say (hypothetical) "Jill has the gene for breast cancer" or "Bill has the gene for CF". This represents a key misunderstanding of simple genetics: all of us have the BRCA1/2 and CFTR genes for example. Only some of us have DNA sequence variants that are associated with disease pathology. This is the type of misconception that can be corrected with a more nuanced set of HS Life Science standards.

If Maine wants a well-informed population, able to understand and manage their health and healthcare it is essential to embrace new knowledge in the HS-LS3 standards.

HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Further explanation: Emphasis is on using data to support arguments for the way variation occurs. Provide data on specific mutations caused by environmental factors.

Engaging in Argument from Evidence, Variation of Traits, Cause and Effect

Comments (Wray Jackson Lab): *Standard on evolution* ***HS-LS4-****2 uses the term* ***heritable, not inheritable.*** *This is inconsistent; best approach it to change this usage to heritable.*

Further: This standard could be updated as well. Relative to heritability of traits and item 3 'mutations':

The great majority of HS learners do not understand that a mutation in a skin cell (somatic tissue) is not passed on to offspring. Mutation driven by environmental factors needs to occur in germ line cells, sperm or eggs, to be heritable. (With some epigenetic exceptions, but epigenetics is likely best left out of basic LS standards for HS).

This is not to say that DNA/genomic sequence variation is irrelevant in somatic tissue; it is important to health and causes disease; it would just be good to be sure that heritability is well understood and spelled out by the standards.

On the explanation emphasis. The explosion of genomic data has extensively highlighted that vast amounts of sequence and structural variation occurs in animals, plants etc. This base amount of variation is much more extensive than many geneticists could have predicted. Reshuffling of such natural variation through sexual reproduction, even without #2 replication errors or #3 germ line mutation (both being rare at the individual level), is much more a driver of characteristics/phenotypes than this standard suggests. So, the standard seems to carry forward an only partially correct imprint or impression that environmental

driven mutation and replication errors are of equal importance to the effects of reshuffling natural genetic variation.

HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Further explanation: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits. An example would be the population of red fox in Maine and the incidences of the red allele vs. the sable allele.

Analyzing and Interpreting Data, Variation of Traits, Scale, Proportion, and Quantity

Comments (Wray Jackson Lab): *This standard also reinforces the one gene-one protein-one trait, simplified approach.*

The explanation/emphasis could be shifted to using math and probability to explain human height/stature. It is now known that 100's of genes and environmental factors play a role in human height. It is the combinatorial effects of these many genes that lead to a normal distribution of human heights (actually to bi-modal distribution of height by sex). This visible phenotype (height) lends itself to applying probability and mathematics to explaining the multigene/polygenic traits.

HS-LS4 Biological Evolution: Unity and Diversity

HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Further explanation: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.

Obtaining, Evaluating, and Communicating Information, Evidence of Common Ancestry and Diversity, Patterns

HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Further explanation: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.

Constructing Explanations and Designing Solutions, Adaptation, Cause and Effect

HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

Further explanation: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations. Observe historical data for the distribution of humpback whales in the Gulf of Maine looking specifically at skin pigmentation.

Analyzing and Interpreting Data, Natural Selection, Adaptation, Patterns

HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
Further explanation: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.
Constructing Explanations and Designing Solutions, Adaptation, Cause and Effect

HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
Further explanation: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.
Engaging in Argument from Evidence, Adaptation, Cause and Effect

HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
Further explanation: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.
Using Mathematics and Computational Thinking, Biodiversity and Humans, Developing Possible Solutions, Cause and Effect

At Kennebunk High School we have integrated the NGSS science and engineering practices as graduation standards for all students allowing them to take a variety of science classes that apply those skills. Students will meet some of the content standards in the classes but not necessarily all content standards for all classes. This allows students to have control and flexibility in their science pathways while still learning things like modeling and data analysis and has worked well for us.
Erin Boggs

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Erin K. Boggs MSES
Science Teacher (she/her)
Kennebunk High School
89 Fletcher St.
Kennebunk Me. 04043

To: Maine Department of Education

Re: Science & Engineering Standards

Date: Mar 21, 2023

From: Ernest M. Colvin, Science Teacher at Maranacook Community High School

To whom it may concern,

Thank you for taking the time to listen to public concerns and observations regarding Maine's current Science & Engineering Standards. Having taught in public schools in Maine for only 4 and a half years I am not as familiar with previous Maine standards but have spent a majority of my career teaching in other states that years ago either rejected the NGSS or adopted them. These experiences have led me to an understanding that NGSS is a board-facing document rather than a teacher-facing one and should be viewed in such a way.

In a state such as Maine that has traditionally valued local school district control, NGSS has not served the community well when used by teachers to determine curriculum. The nebulous nature of the standards allow for too great a diversity of effort in a field that requires many lock-step prerequisite experiences. That is not to suggest a complete dismantling of the current standards is necessary but rather I would suggest a parallel document that is NGSS compliant and content specific in a more teacher-facing way.

Years ago when I was teaching in Ohio it was determined at that time by the state to reject the NGSS due to the unnecessary "unpacking" required. While there was acknowledgement of certain key pieces of wisdom it was decided that teacher work time should not be involved with this unpacking. A few years later while teaching in Wisconsin the standards were adopted and the unpacking did begin. However, in time NGSS was pushed to take more of a backseat in favor of specific teacher-facing standardards.

Maine is faced with a teacher shortage and a few studies have noted that teachers who have left the profession have done so in part due to perceived unnecessary work and an over-broadening of responsibilities. More content specific teacher-facing documents may provide a simplicity that is currently called for at least with regard to curriculum work.

Thank you for your time.

Ernest Colvin

Good morning,

Where are our Computer Science standards? As a computer science and media teacher, I balance all of my classes on multiple standards pulled from multiple sources- because our state does not have computer science standards. Thank goodness for ISTE and CSTA. Our state needs to include computer science standards in our materials. Please. Right now I teach from the Career Preparation Department, and use those standards to help guide my curriculum. But I need the CSTA standards to create a real focus. And being in Career Prep means it's an "elective." Computational thinking and literacy should be a requirement.

Please help add these vital standards to our state. At SPHS we say "students graduate demonstrating computer literacy" but that's only because they're given an iPad through the 1:1 program. We need actual standards to make it more equitable.

Thank you.

-Julie York
she/her/hers
yorkju@spsdme.org
South Portland High School
Career Preparation Department Chair
SMCC Concurrent Instructor
SPCTV-2 Educational Access Coordinator
2022-23 CSTA Equity Fellow
SPHS Website Administrator
http://highschool.spsd.org

I am a high school physical science teacher (chemistry and physics courses).
I find it easy to design and implement a meaningful curriculum for PS1 in honors chemistry. I also cover PS2-4 for Coulomb's law in chemistry. In the general intro to 9th grade physics classes, I am able to do PS2-1 and PS2-3 well, but I have struggled to do enough content deeply since we went remote in the pandemic and now even with a full return to school students have struggled to move through content at the same pace as prior to the pandemic, so I have not always reached PS2-2 or PS2-4 with enough time to bring students to proficiency in those standards, instead leaning into fully developing proficiency in the other two standards. PS3-1, PS3-2, and PS3-4 are done in my chemistry courses, while PS3-3 is done in intro to physics. PS4, both parts, are not covered in either of my courses, and have not ever been, so this is the greatest area of deficit for me and my students. At my school, we use the NGSS practices as graduation standards and students are able to take many different pathways through the courses to graduation. This means they get multiple opportunities and context for using the science practices, but they do not necessarily all have experience with each of the science standards in high school. In fact, most of our students will not have encountered many of these standards depending on which pathway they choose.
If someone would like to further discuss my comments I am happy to do so.
Sincerely,
Lisa McLellan

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Lisa KF McLellan
she/her/hers
Science Teacher
Science Competitions Coach
PAEMST 2013 Awardee
Kennebunk High School

Greetings,
I am writing to provide feedback on the science teaching standards for the state of Maine. I am currently in my first year of teaching high school chemistry and physics at Washington Academy in East Machias. I was a chemist in industry after college, then a mother, and now an educator. As I developed my curriculum for my classes last semester (we operate on a semester block schedule), I leaned heavily on the state standards to guide my direction. By picking out the chapters in the book that corresponded to the physical science standards for high school, I was able to create a meaningful curriculum for my classes. The standards were not too specific that I could not tailor the content as needed to adapt to the needs of my students, yet they were specific enough that they acted as a roadmap to guide me to make appropriate cuts to the text material in order to fully cover all of the standards. I felt confident at the end of the semester that I had guided the course according to our state standards, and given a meaningful curriculum to my students. The one thing that I would like to add that could be helpful to new teachers like myself, would be a link to labs that align with the standards or more in depth detail given. For example:

> **HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.**
> Further explanation: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules. Examples could include the varied rates of oxidation of metals in winter vs in summer or the rate of dissolution of calcium shells in the ocean due to an increase in carbon dioxide an increase in temperature from global warming.
> Constructing Explanations and Designing Solutions, Chemical Reactions, patterns

It would be nice if there was a link that someone could click on to see examples of labs that teachers could do with students to demonstrate these examples, instead of just stating out what the examples are: " Examples could include the varied rates of oxidation of metals in winter vs in summer or the rate of dissolution of calcium shells in the ocean due to an increase in carbon dioxide an increase in temperature from global warming" Instead of just say "examples", perhaps there could be a link embedded to lead a teacher to a specific lab demonstrating this principal. I spent a good deal of time combing through lab books to align appropriate low-waste/zero-waste labs to my curriculum. It would be great if all teachers were provided good examples of low-waste/zero-waste labs to align with the state standards. Even if a teacher has been teaching for 20 years, they could still benefit from seeing fresh ideas, or maybe ideas they had not considered. Especially in thinking about our global footprint of lab waste, moving towards low-waste/zero-waste labs is a smart move for any classroom.
Thank you,
Mrs. Mindy Dean (she/hers)
Science Department
Washington Academy
(207) 255-8301 x.245
PO Box 190
East Machias, ME 04630

March 20, 2023

Maine Department of Education, Attn: Beth Lambert
23 State House Station
Augusta, ME 04333
RE: Science Standards Review

Dear Maine Department of Education,

Maine educators having only recently adopted our current set of standards, Maine Science Teachers Association feels strongly this current review should be for egregious errors only. None have been found in the standards. With the fairly recent development of aligned instruction materials, any major shifts would cause a reset to the work that has been done thus far. The standards, and the framework upon which they are based, were extensively reviewed by Maine educators, as Maine was a lead state during the development period of the national standards. We remain confident that this set of standards, well implemented, is accurate, correct, and vital for a strong, research-based science education for all Maine students.

It would be extremely beneficial if there was state-wide professional development on understanding and implementing the high-quality science instruction that these standards promote. This has not been provided since the Framework was introduced. Assessments (state, district, and classroom) that are aligned with the three dimensions, are needed and must mirror instruction. We urge that the MDOE hire and support at least one science education content specialist.

Finally, we also urge that regional science education leadership collaboratives that are rich in teacher leaders, school administrators, higher education faculty, and NGO representatives be established to support and advocate for science learning by all Maine students.

As the leadership within the Maine Science Teachers Association - the professional association for science educators in Maine - we look forward to being actively involved

in this review process, as well as assisting with the promotion and implementation of any statewide professional development.

Thank you.

Maine Science Teachers Association Board

Tonya Prentice
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(207)418-8278

Maine Curriculum Leaders Association

Championing Policies And Practices That Enhance Teaching And Learning

Science Standards Review

Senator Rafferty, Representative Mike Brennan and distinguished members of the Joint Standing Committee on Education and Cultural Affairs.

My name is Debra McIntyre, and I am the Executive Director for the Maine Curriculum Leaders Association. MCLA recognizes the MDOE is required to review content area standards on a regular and ongoing basis. We also recognize the amount of work this requires and are always looking to be partners in this work. The members of MCLA are recommending that the Maine science standards, which are aligned to the national standards, are reviewed, and revised only to make changes to any errors that exist in the current document. We strongly believe that the standards, as they exist, are supportive of the teaching and learning of both processes and specific scientific knowledge. We know that there are resources and programs that the field can access that are in alignment to the national standards and supports implementation of these standards.

If our Maine standards were dramatically altered, this would have a large impact on teachers and school districts (curriculum development, resource, and program purchases).
Thank you for your consideration.

Dear Science Standards Review committee,

As you begin the review process for Maine Science Standards, I highly encourage and request that we continue to support the NGSS as the Maine Learning Results.

Not only do the NGSS support rigorous and relevant learning for the world that we live in, and the future, but they require students to think deeply, and engage in actual science.

The high level questioning, investigating, and evidence supported conclusions are essential to our students' (and the world's) future. Empowering students to be scientists rather than the receptors of knowledge others have already obtained (we can all just Google and get that level of information). When they are engaged in the science, they are learning the skills to discover the unknown (to them) and use these problem solving and perseverance skills in all aspects of their lives. We want our students to be the builders of tomorrow, and they need the skills to create that unknown future world.

Keeping the NGSS as our MLRs also allows Maine educators access to a variety of resources that have been peer reviewed or created by other educators across the country. If Maine was to create their own standards, we would lose out on some of these resources. Collaboration and learning from other educators is paramount to ensure that Maine students continue to receive the education they deserve.

Thank you for the continued support for high level and relevant science learning for Maine students, and educators.

Robert Ripley, M.Ed
Lead Teacher and Sixth Grade STEM
Pronouns: he/him/his
Harrison Elementary School
Oxford Hills School District, Maine
207-583-2357

Hi,
I'm an 8th grade National Board Certified science teacher and I love that Maine has adopted the NGSS. It is SO important for science content to be aligned across states, and using standards that address the practices as well as the content. The NGSS are a valuable tool to teach students that science involves more than just facts, it is a subject that involves writing, data analysis and mathematical computation. I think using these standards elevates the level of teaching as well, as we are guided in our approach with Performance Expectations and Evidence statements.

The only area I can see where the NGSS are barriers to instruction is if districts feel like they need to be implemented only as performance expectations. Teachers need the flexibility and the training to use the NGSS Performance Expectations as a guide, and not an absolute directive in how the standards should be assessed. The NGSS are designed to be viewed through multiple lenses, with instructors being able to pair a DCI, Practice and Cross cutting concept together in unique ways.

The NGSS are great, but teachers and districts need training and time to learn how to implement them in a meaningful way that generates high level, scientifically minded students in our state. Being aligned with instruction across other states, using standards that were thoughtfully written based on extensive evidence based research is something Maine should continue to be committed to.

--
Robin Tiller
she / her / hers (Why are my pronouns listed here?)
8th Grade Science Teacher
Team Doubletop
Greely Middle School

March 20, 2023

RE: Science Standards Review

Senator Rafferty, Representative Mike Brennan and distinguished members of the Joint Standing Committee on Education and Cultural Affairs,

First we do apologize for not being in attendance personally, this public hearing is taking place during the week of the National Science Teachers Association conference in Georgia which our leaders are attending. We regret our lack of attendance.

The Maine Science Teachers Association feel strongly that due to Maine educators having only recently adopted our current set of standards this current review should be for egregious errors only. None have been found in the standards. With the fairly recent development of aligned instruction materials, any major shifts would cause a significant reset to the work that has been done thus far. The standards and the framework upon which they are based, were extensively reviewed and supported by numerous Maine educators. We remain confident that this set of standards, well implemented, is accurate, correct, and vital for engaging, strong, research-based science education for all Maine students.

It would be extremely beneficial for Maine science educators and ultimately Maine's students if there was state-wide professional development on understanding and implementing the high-quality science instruction that these standards promote. Professional development has not been provided since the Framework was introduced. Assessments (state, district, and classroom) that are aligned with the three dimensions of the standards are needed and must mirror our instruction. We would like to add that we urge that the MDOE hire and support at least one science education content specialist to help with these tasks.

As the leadership for the Maine Science Teachers Association - the professional association for science educators in Maine - we look forward to being actively involved in this review process, as well as assisting with the promotion and implementation of any statewide professional development.

Respectfully submitted by,

Maine Science Teachers Association Executive Board
mainescienceteacherspresident@gmail.com