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TO: Members of the State Board of Education

FROM: Jack R. Smith, Ph.D. JRS/CLA

DATE: March 21, 2016

SUBJECT: Maryland Science Program

PURPOSE:

The purpose of this agenda item is to provide follow up information regarding the implementation of the Next Generation Science Standards (NGSS), which have been adopted as the Maryland State Science Standards.

BACKGROUND/HISTORICAL PERSPECTIVE:

Maryland adopted the NGSS on June 25, 2013, and an update on implementation was shared at the February 12, 2016 State Board meeting. Documents were shared that provide an overview of the implementation of the standards, the instructional outcomes, and assessment progression they are designed to achieve. In addition, district representatives presented their insights into the implementation of the Maryland State Science Standards in their schools and districts. State Board members requested additional information regarding the national NGSS implementation efforts for integrated content and assessments, as well as information on communication initiatives.

Achieving the goals of the NGSS has been a long-term systemic effort that requires significant shifts in instruction, curriculum, assessment, teacher preparation and professional development, accompanied by significant financial, administrative, and public support in adoptive states. It is a shared and collaborative responsibility, and Maryland has focused on including all stakeholders at the local, district, and state level to achieve the goals of the NGSS.

In order to achieve successful implementation with fidelity of the NGSS in schools and districts in Maryland, a considerable amount of thoughtful and reflective preparation time has been expended and will continue to be devoted towards the goals for science educators and school leaders to understand the shifts, participate in professional development to support the changes, implement trial or pilot work, and initiate the changes.

Maryland State Department of Education (MSDE) science staff shared the significant amount of time spent on district site visits and updates to continually monitor educators' growth and improvement as well as provide feedback focused on Maryland educators' work to become proficient in the new NGSS-based strategies, materials, and assessments.

Full implementation of the NGSS includes the complete scope of changes or modifications necessary in all systems of the K–12 science education to support student performance to the NGSS expectations. These systems include instruction, curriculum, assessment, teacher preparation, and professional development, as well as communication.

All students can develop science proficiency if the instruction provides them with opportunities for engagement in scientific investigations and thinking. Opportunities to collect and analyze data, engage in argument from evidence, communicate and apply information, and construct explanations and design solutions are critical components.

For successful implementation, the goal is for students to build upon and apply knowledge in a coherent progression within each year or course, and over the 13 years of their Pre-K–12 educational experience. MSDE continues to communicate to all stakeholders that the Maryland State Science Standards and NGSS as a whole are sets of standards and do not dictate a particular curriculum, scope and sequence, or instructional materials, but instead provide guidance to inform important decisions around these selections. A curriculum that is aligned provides a cohesive sequence of core ideas within each grade and grade band from kindergarten to grade 12 that is consistent with the progression of core ideas from the NGSS. With significant support from MSDE, districts are still at varying stages in the process of changing the structure of courses and the total Pre-K–12 curriculum sequence that currently exists.

Teacher development from initial preparation through ongoing professional development is essential to support the implementation of the aligned curriculum. Teachers need a thorough understanding of the disciplinary core ideas, science and engineering practices, and crosscutting concepts they are expected to teach, how students learn them, and the range of instructional strategies that can support student learning. Throughout the process, districts have been sharing with MSDE and each other their progress in the areas of both curriculum development and teacher preparation.

Assessment development is also a collaborative statewide effort in Maryland. It was shared in the February 12, 2016 State Board meeting that performance expectation (PE) selections for the Maryland Integrated Science Assessment (MISA) will focus on the crosscutting concepts and science and engineering practices that allow students to become scientifically literate and able to successfully respond to rigorous assessments based on the disciplinary core ideas which will best prepare students for success in college and careers.

This work focuses on the NGSS performance expectations which describe what students should know and be able to do within each grade level or grade band for the purposes of assessment. Bundling of performance expectations will be done with attention to assessment tasks based on authentic phenomenon. The assessments will be developed using a variety of NGSS performance expectations that reflect progressions across grades 3-12. Maryland science educators are also

collaborating on using performance expectations to modify and guide the development of classroom/formative and summative assessments at all levels of an assessment system (classroom, school, district, and state). Developing performance assessment tasks using performance expectations which integrate science and engineering practices, disciplinary core ideas, and crosscutting concepts is a time-consuming and labor-intensive development process, and Maryland is at the cutting edge in this development.

Finally, it is important that communication to all stakeholders creates a common understanding of the goals, structure, and use of the Maryland State Science Standards. At the February 12, 2016 State Board meeting, the Board Memo included Attachment III *Maryland State Integrated Science Assessment Progression Elementary/Middle School* and Attachment IV *Maryland State Integrated Science Assessment Progression High School* which each incorporate a section on the Parent/Community Communication efforts at the state level. MSDE continues to work to build awareness and understanding among stakeholders, while helping educators fully prepare for the Standards.

EXECUTIVE SUMMARY:

State Board members requested additional information regarding the national NGSS implementation efforts for integrated content and assessments, as well as information on communication initiatives.

In the February 2016 report, *21st Century Science Assessment: The Future is Now*, James Pellegrino summarizes research and recommendations for the future of integrated, NGSS aligned science assessments:

> "At their core, science assessments are statements about what scientists, educators, policy makers, and, indirectly, parents want students to learn and, in a larger sense, become. What we choose to assess in science is what will end up being the focus of instruction. Education research has well established that teachers and students take their cues from large-scale achievement tests and will try to score well on them regardless of the assessment type, especially when high stakes are associated with the outcomes. So it is critical that our science assessments best represent the kinds of learning we want to occur if our students are to achieve the forms of proficiency needed for the worlds of today and tomorrow."

The report also addresses why a consortium model is not recommended as states work to create assessment systems:

> "The current educational assessment environment in the United States clearly reflects the considerable value placed on external, large-scale assessments of individuals and programs relative to classroom assessments designed to assist learning. The resources invested in producing and using large-scale tests in terms of money, time, research, and development far outweigh the investment in the design and use of effective classroom assessment. A lesson can be learned from the investment made (via the U.S. Department of Education's Race to the Top

> program) in large-scale assessments developed by the Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced (SBAC) state consortia for the Common Core State Standards in English language arts (ELA) and mathematics. Experience with this Race to the Top effort suggests that to better serve the goals of learning, the investment in assessment research, development, professional development, and training should be shifted toward the classroom, where teaching and learning occur."

From a national perspective, the eighteen NGSS adoptive states range along the continuum of implementation for both the aligned content and assessments. Like Maryland, all of these states are working to create high quality instructional materials that will generate student work that will be able to show how students are progressing in the three-dimensional science classroom. These artifacts of student performance from the classroom are providing models as we work to create summative assessments that truly mirror classroom instruction. Additionally student work provides observable evidence of classroom, school, and district implementation of the NGSS that could also provide information of progress to the state. This "classroom up" progression is the hallmark of the NGSS assessment system model.

Sharing success from the "classroom up" has been a focus of Maryland's communication efforts. MSDE science staff has built a community of learners around this implementation work. Communication materials have been shared with districts for their public relations and professional learning initiatives, and MSDE's Office of Communications is planning additional statewide efforts. Editorials are also being written by Maryland educators to share their stories of the power of the Maryland State Science Standards and how they have transformed teaching and learning in their classrooms.

ADDITIONAL RESOURCES:

NGSS Website: http://www.nextgenscience.org/

Appendix K: Model Course Mapping in Middle and High School for the Next Generation Science Standards:
http://www.nextgenscience.org/sites/default/files/Appendix%20K_Revised%208.30.13.pdf

MSDE eConnect science resources: http://msde.blackboard.com

Docushare Folder including:

- Sample Communication Materials
- Board on Testing & Assessment (BOTA) Resources

ACTION:

For information only.

NGSS Parent-Community Communication Documents

- Why K-12 Standards Matter
- NGSS 101 for General Audience
- Public Attitudes Toward Science Education
- NGSS Messaging Cards
- NGSS Fact Sheet for Parents
- 10 Questions Your Kid's Science Teacher Wishes You Would Ask
- NGSS Chart - How Will Science Education Change with NGSS

SCIENCE EDUCATION IN THE 21ST CENTURY

Why K–12 Science Standards Matter—and why the time is right to develop Next Generation Science Standards

Why Next Generation Science Standards (NGSS)?

- It has been 15 years since science standards were revised. Since that time, many advances have occurred in the fields of science and science education, as well as in the innovation-driven economy.
- The U.S. has a leaky K–12 STEM talent pipeline, with too few students entering STEM majors and careers at every level—from those with relevant postsecondary certificates to PhD's. We need new science standards that stimulate and build interest in STEM.
- We can't successfully prepare students for college, careers and citizenship unless we set the right expectations and goals. While standards alone are no silver bullet, they do provide the necessary foundation for local decisions around curriculum, assessments, and instruction.
- Implementing improved K–12 science standards will better prepare high school graduates for the rigors of college and careers. In turn, employers will be able to hire workers with strong science-based skills—including specific content areas but also skills such as critical thinking and inquiry-based problem solving.

What Are the Next Generation Science Standards?

- The Next Generation Science Standards (NGSS) will create K–12 science standards through a collaborative state-led process.
- The NGSS will be arranged in a coherent manner across grades and provide all students access to a challenging science education, and be based on the *Framework for K–12 Science Education,* developed by the National Research Council, the staffing arm of the National Academy of Sciences.
- Every NGSS standard has three prongs: content, scientific and engineering practices and cross-cutting concepts. The integration of rigorous content and application reflects how science is practiced in the real world.

How Are the NGSS Being Developed?

- The NGSS are being developed in a two-step process in partnership with the National Research Council (NRC), the National Science Teachers Association (NSTA), the American Association for the Advancement of Science (AAAS) and Achieve.
- The *first step* was the development of the *Framework for K–12 Science Education* by the National Academies of Science that identified the broad ideas and practices in natural sciences and engineering that all students should be familiar with by the time they graduate from high school.
- The *second step* is the development of standards based on the *Framework,* which will engage science educators and experts from around the country who will serve as writers and

will produce drafts of the standards. Achieve is managing this process on behalf of the lead states.

- Twenty-six states are lead state partners in the NGSS development effort.
- There will be two open comment periods where feedback on the draft standards will be open for public comment. The first will occur late spring 2012 and the second will be in the fall of 2012.
- The NGSS are expected to be completed by early 2013. It will then be up to state to determine whether and when to consider adopting the NGSS as their states' science standards.
- States working together to develop and implement NGSS standards makes good common sense—it offers opportunities for states to share best practices, leverage economies of scale in the education marketplace, and will ensure all students—in any state and any district that adopts them—gain the knowledge and skills they need for success in college and careers.

The Urgency for Next Generation Science Standards:

- In 2007, a Carnegie Corporation of New York/Institute for Advanced Study commission of researchers and public and private leaders concluded that *"the nation's capacity to innovate for economic growth and the ability of American workers to thrive in the modern workforce depend on a broad foundation of math and science learning, as do our hopes for preserving a vibrant democracy and the promise of social mobility that lie at the heart of the American dream."*
- Unfortunately, science and mathematics achievement continues to lag compared to our international competitors, and this lag has already begun to impact the competitiveness of young Americans as well as the competitiveness of the U.S. in the global economy.

  For example:

  - The U.S. ranked 17th in science and 25th in mathematics on the 2009 PISA assessment. Less than 10 percent of U.S. students scored at one of the top two of six performance levels.
  - More than a third of eighth-graders scored below basic on the 2009 NAEP Science assessment.
  - U.S. high-tech manufacturing industries continue to have a larger share of global output than any other economy, but the U.S. global share fell from 34% in 1998 to 28% in 2010.
  - The U.S. share of global high tech exports dropped from 19% to 15% in 2010; at the same time China's share of global high tech goods exports more than tripled, from 6% in 1995 to 22% in 2010, making it the single largest exporting country for high tech products.

MARYLAND STATE DEPARTMENT OF EDUCATION
PREPARING WORLD CLASS STUDENTS

The Next Generation Science Standards

WHAT ARE THE NEW SCIENCE STANDARDS?

The Next Generation Science Standards (NGSS) are a new set of K–12 science standards that were developed by states, for states. The NGSS identify science and engineering practices, crosscutting concepts, and core ideas in science that all K–12 students should master in order to prepare for success in college and 21st-century careers.

WHY ARE THEY IMPORTANT?

It has been more than 17 years since the National Research Council and the American Association for the Advancement of Science produced their reports from which most state science standards are based. Since then, there have been major advances in science and our understanding of how students learn science. Students need the kind of preparation that gives them the tools and skills necessary to succeed in a rapidly and continuously changing world.

There are more jobs in science, technology, engineering, and math (STEM) fields than there are STEM-ready applicants. Ensuring students have a more robust STEM education can begin to close this gap.

HOW WERE THEY DEVELOPED?

The NGSS were developed through a collaborative state-led process. Science supervisors from 26 states worked with a 40-member writing team—which included teachers, working scientists, and education experts—to develop the draft standards, based on the National Research Council's document *A Framework for K – 12 Science Education*. Each of the 26 states established a broad-based committee to review draft standards and provide feedback. In addition to those reviews, a larger stakeholder team composed of hundreds of members representing K–12 educators, administrators, higher-education faculty, scientists, engineers, business leaders, policymakers, and key organizations provided feedback during five review periods. The draft standards went through two public review periods and received comments from more than 10,000 individuals.

HOW WILL THE NGSS SUPPORT COLLEGE AND CAREER READINESS FOR ALL STUDENTS AND PREPARE THEM TO SUCCEED IN THE GLOBAL ECONOMY?

A high-quality, robust science education means students will develop an in-depth understanding of content and will gain knowledge and develop skills—communication, collaboration, inquiry, problem solving, and flexibility—that will serve them throughout their educational and professional lives.

The NGSS were benchmarked against countries whose students perform well in science and engineering fields, including Finland, South Korea, China, Canada, England, Hungary, Ireland, Japan, and Singapore.

WHAT WILL THE NGSS LOOK LIKE IN THE CLASSROOM?

High-quality education standards allow educators to teach effectively, moving their practice toward how students learn best—in a hands-on, collaborative, and integrated environment rooted in inquiry and discovery. Teaching based on the NGSS calls for more student-centered learning that enables them to think on their own, problem solve, communicate, and collaborate— in addition to learning important scientific concepts.

THE NGSS OFFER FIVE INNOVATIONS FOR TEACHING AND LEARNING

1. **Three Dimensional Learning:** There are three equally important, distinct dimensions to learning science included in the NGSS: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The NGSS connects all three dimensions. To prepare students for success in college and 21st century careers, the NGSS also connect scientific principles to real-world situations, allowing for more engaging and relevant instruction to explore complicated topics.

2. **All three dimensions build coherent learning progressions:** The NGSS provide students with continued opportunities to engage in and develop a deeper understanding of each of the three dimensions of science. Building on the knowledge and skills gained from each grade—from elementary through high school—students have multiple opportunities to revisit and expand their understanding of all three dimensions by the end of high school.

3. **Students engage with phenomena and design solutions:** In instructional systems aligned to the NGSS, the goal of instruction is for students to be able to explain real-world phenomena and to design solutions using their understanding of the Disciplinary Core Ideas. Students can achieve this goal by engaging in the Science and Engineering Practices and applying the Crosscutting Concepts.

4. **Engineering and the Nature of Science is integrated into science:** Some unique aspects of engineering (e.g., identifying problems) are incorporated throughout the NGSS. In addition, unique aspects of the nature of science (e.g., how theories are developed) are also included throughout the NGSS as practices and crosscutting concepts.

5. **Science is connected to math and literacy:** The NGSS not only provide for coherence in science instruction and learning but the standards also connect science with mathematics and English Language Arts. This meaningful and substantive overlapping of skills and knowledge affords all students equitable access to the learning standards.

COMMON MISCONCEPTIONS ABOUT THE NGSS

Myth: The NGSS were developed by the United States Department of Education.

FACT: The Next Generation Science Standards (NGSS) were developed through a collaborative state-led process. Twenty-six states volunteered to work with the 40 members of the writing team to lead the development of the standards, and each state formed broad-based committees to work on the standards.

Myth: The NGSS were developed without public input.

FACT: The draft standards received comments from more than 10,000 individuals during each of two public review periods. These comments came from teachers, school and school district discussion groups, scientific societies, parents, and students. In addition, an expert team composed of hundreds of members representing K–12 educators, administrators, higher education faculty, scientists, engineers, business leaders, policymakers, and key organizations provided confidential feedback during critical points of the development process.

Myth: The NGSS were developed without teacher input.

FACT: To develop the standards, the science supervisors in the 26 lead states worked with a 40-member writer team, all of whom were education experts and more than half of whom were practicing K–12 teachers. Thousands of teachers also provided comments to the draft standards during the two public review periods and as part of expert review panels.

Myth: The NGSS will force states and districts to adopt a uniform curriculum.

FACT: The NGSS are standards, not curricula. Local districts, schools, and classroom teachers will continue to determine their own curriculum, including what is taught throughout the year and how it is taught.

Myth: The NGSS are part of the Common Core.

FACT: The NGSS are not part of the Common Core State Standards (CCSS). The CCSS only cover mathematics and English Language Arts (ELA)/literacy whereas the NGSS are a separate set of K–12 science standards that were drafted through a distinctly different process.

Myth: The NGSS are funded with federal dollars.

FACT: No federal funding, grants, or formula funding is tied to the adoption of the NGSS nor was used to develop them. The Carnegie Corporation of New York, a foundation dedicated to improving science education in the U.S., provided funding support for the development of the NGSS.

Myth: The NGSS are too rigorous for students who have no intention of pursuing science after high school.

FACT: Science is a key factor in students' ability to think critically and innovate. All students need strong foundational knowledge in science to tackle long-term and difficult issues that face our generation and future generations. A strong science education equips students with skills that are necessary for lasting success in their postsecondary lives and careers.

Myth: The NGSS are not rigorous enough for students interested in advanced classes in high school and beyond.

FACT: The NGSS does not set a ceiling for student achievement. Students who wish to take advanced coursework will still have the opportunity to do so, and the NGSS will provide them with a solid academic foundation for college-level science courses.

Achieve

Attitudes Toward Science Education: Key Findings From A National Survey

America's position as the world leader in innovation is increasingly being challenged by competitor nations that are stepping up their efforts in science and technology—and ensuring that they have an educated workforce up to the task. For too long we have known American students are falling behind in math and science, performing at levels far below students in competitor nations on international tests. Moreover, fewer students are pursuing careers in science, technology, engineering and mathematics (STEM) disciplines at the same time there is a greater demand for the jobs requiring advanced science education or training—from one year post-secondary certificate programs to PhD's.

Business leaders, teachers and the science community have long understood the correlation between improving science education and keeping the United States workforce strong and competitive.

But what does the general (voting) public think? How will the United States maintain its position in a global economy? What changes to science education do voters support? A new poll[1] from Achieve reveals voters' overall attitudes about science education and its significance.

VIEWS ON KEEPING THE US COMPETITIVE THROUGH IMPROVING SCIENCE EDUCATION

- Voters are **virtually unanimous** — 97% — in believing that improving the quality of science education is important to the United States' ability to compete globally.
- A majority of voters give the quality of science education a grade of "C" or below – both nationally (67%) and in their local schools (50%).
- Most voters (56%), believe science education in the United States ranks behind most other countries. This includes majorities across all major sub-groups, including gender, education, region or political affiliation.

Voters believe a quality science education is critical to our country's ability to compete globally. They are underwhelmed by the quality of science education in public schools today, with most viewing it as lagging other nations.

VIEWS ON IMPROVING SCIENCE EDUCATION IN THE CLASSROOM

- Similar to voters' views on English and mathematics standards, by a **margin of almost 2 to 1** (62% to 36%), voters prefer for states to have the same science standards so that students across the country have to meet the same expectations.
- When informed that a group of states are leading the effort to develop new standards that are internationally-benchmarked, more challenging, and will require students to apply their science knowledge and understand how science concepts fit together, voters show **broad support** (87%) for the new standards.

The poll findings demonstrate that state leaders—and their supporters-- who have undertaken developing new science standards together do so with solid support from a majority of voters who believe that the United States could strengthen its position in the global economy through improving science education.

[1]On behalf of Achieve Inc., Public Opinion Strategies and Greenberg Quinlan Rosner Research conducted a national survey February 22-26, 2012 of N=800 registered voters. The poll has a margin of error of ±3.46%.

The Next Generation Science Standards (NGSS)

The Next Generation Science Standards (NGSS)

The NGSS are K–12 science content standards that set the expectations for what students should know and be able to do in science in order to make sense of the world around them and be ready for college, careers, and citizenship.

About the NGSS

1. **The NGSS are for ALL students and provide a science education they can use in real life.** A strong science education equips students with both an ability to make sense of the complex world around them and foundational skills that are necessary for all careers and life.

2. **The NGSS include the latest advances in science and research about how students best learn science.** The NGSS are based on the National Research Council's 2012 document *A Framework for K-12 Science Education*, which provides updated science content and reflects current research about student learning.

3. **The NGSS were developed by states and their educators.** Twenty-six lead states worked with a 40-member writing team composed of classroom teachers, working scientists, and education researchers to develop the standards. Each lead state assembled a team of educators, higher education faculty, scientists, and engineers to provide feedback on the draft standards. Additionally, two public review periods captured tens of thousands of comments during development that were used to revise each draft.

Why is a high-quality science education important for all students?

- **Instruction aligned to the NGSS provides all students — regardless of background, neighborhood, or previous exposure to science — with learning experiences that deepen their understanding of science and how the world works.**
- When current students graduate from high school, more jobs will require skills in science, technology, engineering, and mathematics (STEM) than in the past. **The NGSS provide a strong science education that equips students with the ability to think critically, analyze information, and solve complex problems** — the skills needed to pursue opportunities within and beyond STEM fields.
- As citizens, we are asked to make informed decisions about a variety of issues that affect ourselves, our families, and our communities. **The NGSS not only support students' learning now, but also give students the tools they need to succeed in a rapidly and continuously changing world.**

Learn more about the Next Generation Science Standards at www.nextgenscience.org.

How do the NGSS provide a high-quality science education for all students?

- **The NGSS allow students to develop their knowledge of science as they progress from grade to grade.** The NGSS enable students to build upon their understanding of science over time, while equipping them with the foundational knowledge needed for success in college, careers, and citizenship.
- **The NGSS allow students to learn science by doing what scientists and engineers do.** When students both understand how scientists and engineers practice their craft and have opportunities to carry out investigations and design solutions, they become more engaged in their science learning.
- **The NGSS allow students to think of science learning not as memorization of disconnected facts, but as a cohesive understanding of integrated and interrelated concepts.** There are many themes (e.g., patterns, cause and effect, etc.) that bridge all science disciplines; the NGSS allow students to connect them in order to support their understanding of science and engineering in a clear and cohesive manner.

Next Generation Science Standards
Fact Sheet for Parents

The need for high-quality science education—beginning at the very earliest grades—is more essential now than ever before. Students need the kind of preparation that not only supports their learning now, but also gives them the tools and skills necessary to succeed in a rapidly and continuously changing world. The Next Generation Science Standards (NGSS) are a key component toward advancing high-quality teaching and learning in science.

Overview

- It has been more than 17 years since the National Research Council and the American Association for the Advancement of Science produced their reports from which most state science standards are based. Since then, there have been major advances in science and our understanding of how students learn science. Our students deserve to learn the most current science available taught using the most effective methods.
- The NGSS are a new set of K–12 science standards developed by states, for states. The NGSS identify science and engineering practices and content that all K–12 students should master in order to prepare for success in college and 21st-century careers.
- The NGSS were built upon a vision for quality science education for ALL students—not just a select few.
- The NGSS were benchmarked against countries whose students perform well in science and engineering fields, including Finland, South Korea, China, Canada, England, Hungary, Ireland, Japan, and Singapore.
- The NGSS are NOT curricula. Standards articulate what students need to know and be able to do by the end of each grade level. Districts, schools, and teachers will determine their own curriculum, including what is taught throughout the year, and how it is taught.

How will my child's learning experience be different?

- The NGSS have the potential to revolutionize science education. Not only do they incorporate the most current research and findings in science, they also include the most current research regarding how students best learn science.
- The NGSS allow students to think of science learning not as memorization of disconnected facts, but as a holistic understanding of integrated and interrelated concepts. This is one of the biggest shifts in the NGSS compared to previous sets of science standards.
- The NGSS require students to provide evidence of their learning and will equip students with the critical thinking and analytical skills they need to be successful in college and to compete for today's most rewarding jobs.
- The NGSS connect scientific principles to real-world situations, allowing for more engaging and relevant instruction that clearly covers complicated topics.
- The NGSS better support educators to make science accessible and interesting to ALL students by connecting learning over multiple years, across disciplines and grades and by applying crosscutting concepts to deepen students' understanding of core ideas.
- The NGSS introduces science at an earlier age when children are asking lots of questions about the world and how it works. Most kids love science because they are inherently curious and it is an opportunity for them to have fun and learn at the same time.

Why science education matters now more than ever

- Issues related to science and engineering are all around us in our daily lives. The solutions and innovations human beings can develop to make the world a better place through scientific and engineering knowledge and discovery are endless.
- Global issues like medical research, nutrition, waste disposal, infrastructure development, telecommunications, and cyber-security all require science-based solutions and a basic knowledge of

scientific principles. Today's students need the right foundation to tackle long-term and complex problems that face our generation and future generations.

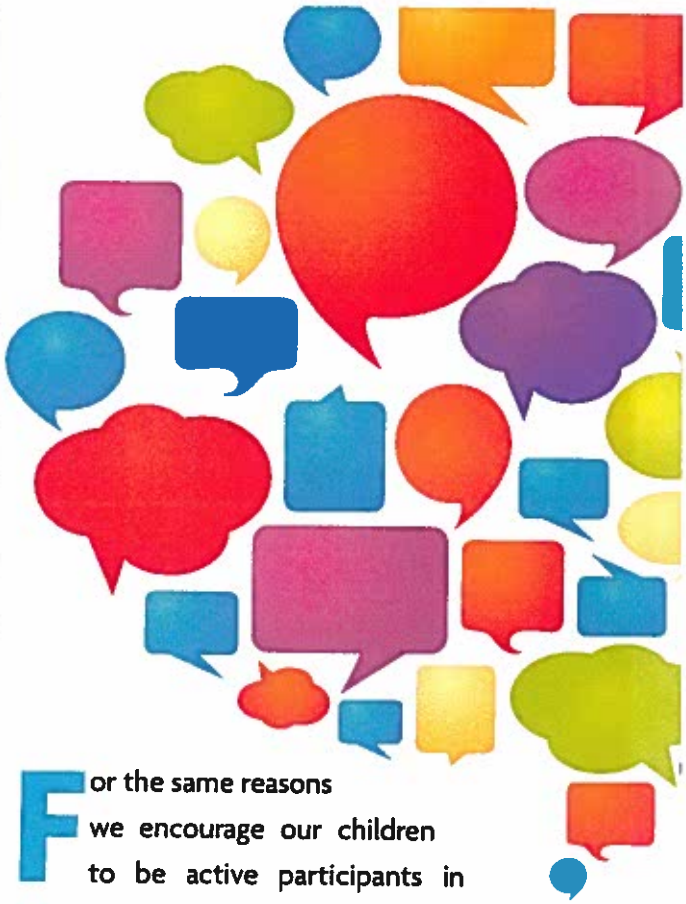
- Students will face unprecedented competition in the workforce not only within their home state and country, but also globally.
    - By 2015, nearly 60% of the new jobs being created will require skills currently being mastered by only 20% of the population, according to a recent report from the American Society for Training and Development.[1]
    - According to the same report, job skills in STEM—science, technology, engineering and math—are among the skills experiencing the greatest increase in demand. In 1991, fewer than 50% of U.S. jobs required skilled workers. But by 2015, 76% of all newly created U.S. jobs will require highly-skilled workers with some proficiency in STEM.
- Of course, science education is about more than building a strong future workforce; it affords students the means to gain resiliency, critical thinking and analytical skills, and the knowledge they need to become capable and informed citizens in a technology-driven world.

Background

The Next Generation Science Standards (NGSS) were developed through a collaborative state-led process. Twenty six states volunteered to work with the 41 members of the writing team to lead the development of the standards. The science supervisors from these state education agencies worked with the writers to provide feedback from their state broad-based committees. These state committees consisted of representatives from the K-12 education, education policy, scientific, post-secondary education, and informal science communities. In addition, a critical stakeholder team comprised of hundreds of members representing K-12 educators, administrators, higher education faculty, scientists, engineers, business leaders, policymakers, and key organizations provided confidential feedback at critical points in the development process. The draft standards also received comments from more than 10,000 individuals during two public review periods. These comments came from teachers, school and school district discussion groups, scientific societies, parents, and students. The writers used this feedback to make substantial revisions to each draft. The final standards were released in April 2013. According to the National Science Teachers Association, 12 states and the District of Columbia have adopted the NGSS as their state science education standards: California, Delaware, Illinois, Kansas, Kentucky, Maryland, Nevada, New Jersey, Oregon, Rhode Island, Vermont and Washington.

[1] "Bridging the Skills Gap," American Society for Training and Development (2010). http://www.astd.org/%20About/~/media/Files/About%20ASTD/Public%20Policy/%20BridgingtheSkillsGap2010.pdf

10 QUESTIONS YOUR KID'S SCIENCE TEACHER WISHES YOU WOULD ASK



For the same reasons we encourage our children to be active participants in classroom discussions, parents should take advantage of opportunities to talk with teachers. Learn more about science teaching and learning in your child's classroom, whether it's during back-to-school night, teacher conferences, or at another point during the school year.

Science lessons deliver some of the most engaging and exciting activities of your child's day. Children are inherently curious and high-quality science instruction allows them to channel that energy and wonder into discovering more about the world around them. As they grow older, science learning helps them develop the necessary skills and practices to solve real-world challenges and build important life skills.

NSTA National Science Teachers Association

The more you know, the more you can support your child's science learning at home. So what should you know about science education at school? Start with these key questions for your child's teacher:

1. **How is science taught in your classroom? What methods or activities do you use? Are there sample lessons I can review?**
2. **What science topics will my child learn and what skills will he/she master by the end of this year? How does this relate to what my child learned last year and what he or she will learn next year? How does it relate to what my child is learning in math, other subjects, or the world in which we live?**
3. **Do you have access to local informal science opportunities? Will there be field trips to local museums or science centers?**
4. **Will there be science homework and what will it look like?**
5. **What types of questions should I ask my child about science on a day-to-day basis?**
6. **What can I do to support my child's science learning? Are there science projects or activities we can do together at home, or apps, websites, or learning games we could explore?**
7. **How does the school support education in science, technology, engineering, and math (STEM) subjects? Is STEM incorporated throughout the day and if so, how? Are there after school STEM clubs, programs, or science and engineering fairs that would support my child's learning?**
8. **How will learning be assessed? Will you use only formal assessments like tests or will children be able to show you what they know through other avenues?**
9. **What happens if my child doesn't achieve the learning goals of a lesson or unit of study? Can he or she get extra help?**
10. **What types of science equipment and technology will be used throughout the year?**

There are no standard answers to these questions, but a teacher who creates a rich classroom environment for science exploration will be happy to discuss them with you. And while you are having this valuable conversation, look around. These are just some of the signs that the classroom environment supports science learning:

- **Space and storage:** Science requires "stuff." Whether the shelves are filled with rocks and leaves or hand lenses and measuring instruments, it's important that teachers have the materials nearby to teach science.
- **Safety equipment:** To explore science in the mode of a scientist, your child will occasionally need eye protection, gloves, soap, and water. There are many experiences that are both simple and safe, but safety criteria must always be in mind.

Whatever the answers are to your questions, a great response to close a conversation would be, "What can I do to help?" Most teachers would be thrilled to know if you have a background in science, technology, engineering, or math, or have time and resources to share.

A strong foundation in STEM will put your child on the road to success in school and beyond. Want to know more about how to support your child's learning in science? Find helpful resources from NSTA at *www.nsta.org/parents*.

Want to learn about how your state might be updating its K-12 science standards for students? Visit *www.nextgenscience.org*.

Produced in partnership with Achieve

Achieve

How will science education change with the NGSS?

Implications of the Vision of the Framework for K-12 Science Education and the Next Generation Science Standards

SCIENCE EDUCATION WILL INVOLVE LESS:	SCIENCE EDUCATION WILL INVOLVE MORE:
Rote memorization of facts and terminology	Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.
Learning of ideas disconnected from questions about phenomena	Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
Teachers providing information to the whole class	Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance
Teachers posing questions with only one right answer	Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
Students reading textbooks and answering questions at the end of the chapter	Students reading multiple sources, including science-related magazine and journal articles and web-based resources; students developing summaries of information.
Pre-planned outcome for "cookbook" laboratories or hands-on activities	Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
Worksheets	Student writing of journals, reports, posters, and media presentations that explain and argue
Oversimplification of activities for students who are perceived to be less able to do science and engineering	Provision of supports so that all students can engage in sophisticated science and engineering practices

NEXT GENERATION SCIENCE STANDARDS For States, By States

NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES

Source: National Research Council. (2015). *Guide to Implementing the Next Generation Science Standards* (pp. 8-9). Washington, DC: National Academies Press. http://www.nap.edu/catalog/18802/guide-to-implementing-the-next-generation-science-standards

Attachment – Tab 3

Maryland Science Program

March 21, 2016

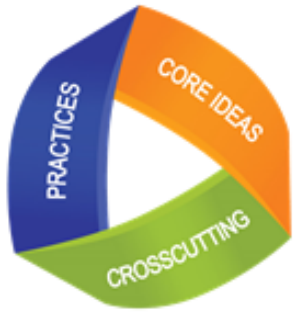
Dr. Henry Johnson, Interim Deputy State Superintendent
Heather Lageman, Director of Curriculum

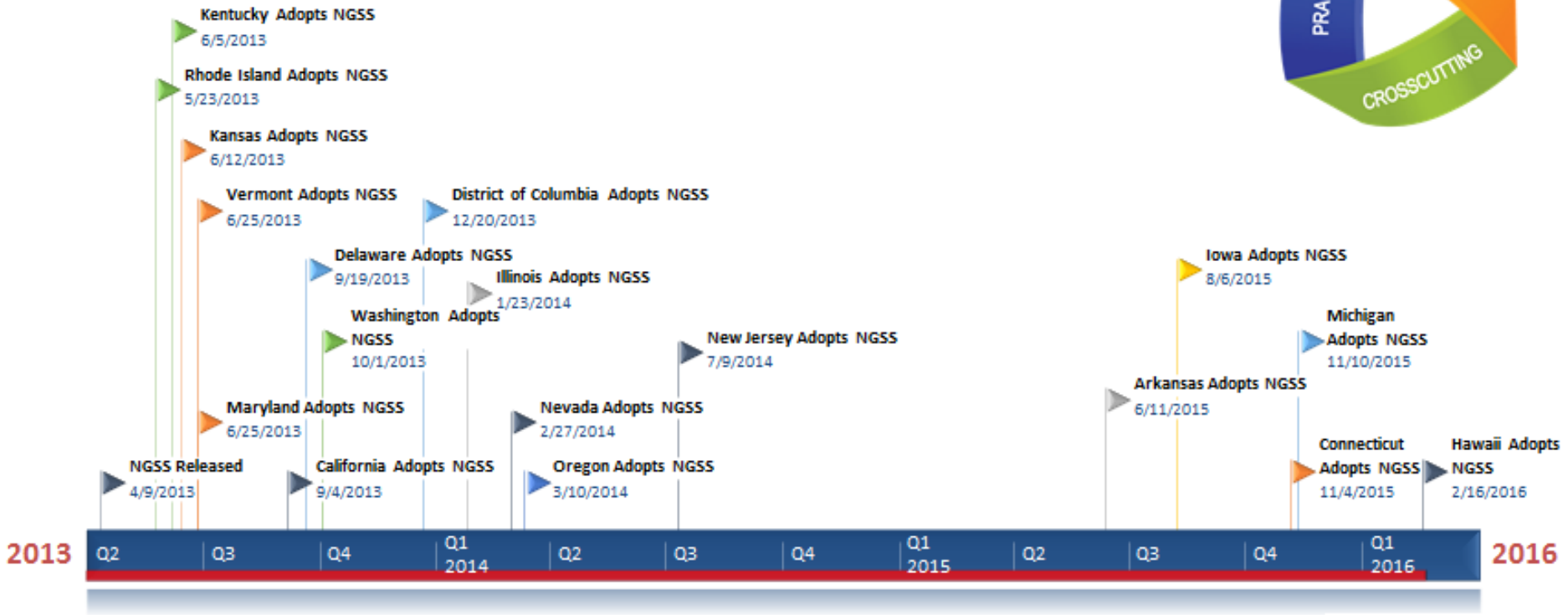
Agenda

- National Integrated Content Implementation
- National Integrated Assessment Implementation
- Communication Materials

MARYLAND STATE DEPARTMENT OF EDUCATION
PREPARING WORLD CLASS STUDENTS

Next Generation Science Standards – Who Has Adopted?

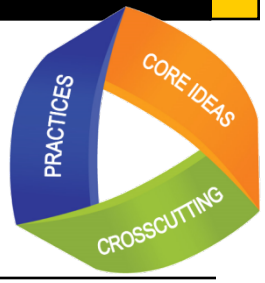




NEXT GENERATION SCIENCE STANDARDS

MARYLAND STATE DEPARTMENT OF EDUCATION
PREPARING WORLD CLASS STUDENTS

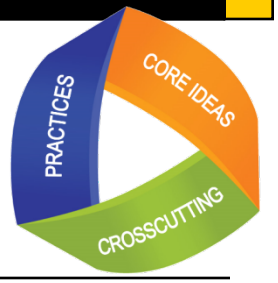
18 NGSS Adopted States (adoption date)



- Arkansas (June, 2015)
- California (September, 2013)
- Connecticut (November, 2015)
- Delaware (September, 2013)
- District of Columbia (December, 2013)
- Hawaii (February, 2016)
- Illinois (February, 2014)
- Iowa (August, 2015)
- Kansas (June, 2013)
- Kentucky (June, 2013)
- Maryland (June, 2013)
- Michigan (November, 2015)
- Nevada (February, 2014)
- New Jersey (July, 2014)
- Oregon (March, 2014)
- Rhode Island (May, 2013)
- Vermont (June, 2013)
- Washington (October, 2013)

MARYLAND STATE DEPARTMENT OF EDUCATION
PREPARING WORLD CLASS STUDENTS

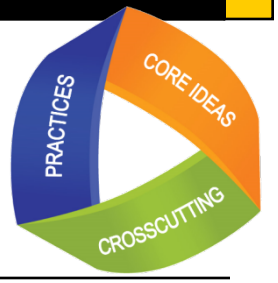
Anticipated NGSS Adopting States (anticipated adoption date)



- New Hampshire (2016)
- Minnesota (2017)
- New Mexico (2016)

MARYLAND STATE DEPARTMENT OF EDUCATION
PREPARING WORLD CLASS STUDENTS

3-Dimensional Science Standards States*



- Alabama
- Georgia (in review)
- Idaho (in review)
- New York (in review)
- Oklahoma
- Pennsylvania (in revision)
- South Carolina
- South Dakota
- Utah (Middle School Only)
- West Virginia

*3–dimensional states listed used the *Framework for K-12 Science Education* as the guiding document for standards development and have modeled their standards in a similar manner to NGSS.

MARYLAND STATE DEPARTMENT OF EDUCATION
PREPARING WORLD CLASS STUDENTS

National Integrated Assessment Implementation

- To date, only the District of Columbia and Illinois have partnered in an effort to engage students using interrelated questions set in real-world contexts or scenarios to assess three-dimensional science learning.

National Integrated Assessment Implementation

- Kansas and Nevada report field testing aligned items beginning in 2015-2016 and 2016-2017.
- Kentucky is working with WestEd as a thought partner to attempt to develop a comprehensive assessment system that is coherent from the classroom all the way up to the large scale summative assessment.

Communication Materials

- Have been shared with district Science Supervisors and used in district communications
- Have been shared with MSDE's Office of Communications and additional statewide rollout of the materials to all stakeholders is planned. Op-Eds are being developed and will be featured on our website as well.

MARYLAND STATE DEPARTMENT OF EDUCATION
PREPARING WORLD CLASS STUDENTS