

The Future of Science Education in California:

The Promise of the Next Generation Science Standards for Students and Communities

CALIFORNIA and the nation have embarked on an ambitious effort to revitalize education and put us on the path to instruction that stands with the very best in the world. The Common Core State Standards (CCSS), adopted by California in 2010, introduced higher expectations for student performance in mathematics and English Language Arts (ELA). Now, a 26-state consortium has developed the Next Generation Science Standards (NGSS) to similarly enrich science instruction.¹

The NGSS provide a vital opportunity to ensure that students will have the world-class science education they need to succeed and to support our state's economy at globally competitive levels. But the NGSS are only a proposal today, and a sustained effort by Californians will be needed to realize their promise for students.

The public discussion on these standards is just beginning in local school districts and among leaders across the state. Although the stakes are high, the State Board of Education is required to decide on the NGSS this year, so the time to act is short. Improving science education is important to all Californians' interests, so it is essential

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that education, business, parent and community leaders become informed about the NGSS and make their desires known to policymakers.

The Critical Need for Improved Science Instruction

In today's global economy, growth and prosperity are driven by the fields of science, technology, engineering and mathematics (referred to as STEM). Seven of the 10 fastest growing occupations are in STEM fields,² and demand for over 1 million STEM jobs is projected in California by 2018.³ Yet, our state faces shortages of qualified workers in precisely these fields, in significant part because our education system is not preparing students with the scientific and technological understanding they need for the future. California students are falling behind their peers nationally and internationally in both science and math achievement. Our

elementary and middle school students rank 44th or lower among all US states in science proficiency.⁴

Moreover, unconscionable gaps in outcomes exist between African-American, Latino, and low-income children — who constitute the vast majority of our students — and their white, Asian, and more affluent peers, gaps that widen as students progress

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through the education pipeline. These results should not be surprising, since many students, especially those in high-need schools, face low expectations, insufficiently challenging coursework and teachers without adequate training in STEM subjects.

According to a 2011 study, only about 10% of California elementary students experience science instruction that regularly engages them in the practices of science, and only about one-third of California elementary school teachers feel “very prepared” to teach science.⁵

We can only reverse this troubling reality if all California students, not just a privileged few, have access to high-quality STEM education from the earliest grades through high school, college and beyond. The NGSS offer an essential, promising step toward this needed change. These standards are intended to guide K-12 science instruction — instructional materials, teacher training, and assessments would be developed based on them. The resulting rigorous science education will allow every student to graduate from high school better prepared to successfully negotiate college and 21st century careers. From this more effective learning, employers, in turn, will be able to hire the qualified workers they need.

WHY NGSS?

Standards for Deeper and More Active Student Learning

The NGSS are based on the latest research from the National Research Council on how students learn most effectively and have been internationally benchmarked against standards of other high-performing countries such as Singapore, Finland, and Japan. The NGSS would combine with the CCSS to bring much needed transformation to teaching and learning by focusing on deepening students’ conceptual understanding, critical thinking and communication skills.

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It has been 15 years since California last adopted new science standards. The NGSS not only reflect the major advances in science of the last two decades, they also focus strongly on teaching students the practices that scientists and engineers use to apply the knowledge of science to solving real-world problems. (See *Three Dimensions of NGSS* on the back page.) By teaching science more like it is actually practiced in the real world, the new standards make science relevant, approachable, and more engaging to every student. Other important features and benefits of NGSS are that they:

- * **Align with ELA and Math:** NGSS standards align with CCSS standards, by grade level, to make science an integrated part of every student’s comprehensive education.
- * **Promote Equity:** The new standards include performance expectations at every grade level and will bring consistency across our schools and communities that may increase equity and opportunity for disadvantaged children.
- * **Increase Hands-On Learning:** NGSS focuses more on learning through hands-on experience and real world problem-solving that applies science to life, rather than focusing on fact memorization alone.
- * **Integrate Engineering:** Engineering design and technology applications are explicitly incorporated throughout K-12 science study.
- * **Provide National Comparability & Cost Efficiency:** The new standards provide cross-state comparability that will expand the market of instructional materials and professional development — driving down costs — while allowing student performance comparisons that can inform instructional improvements.

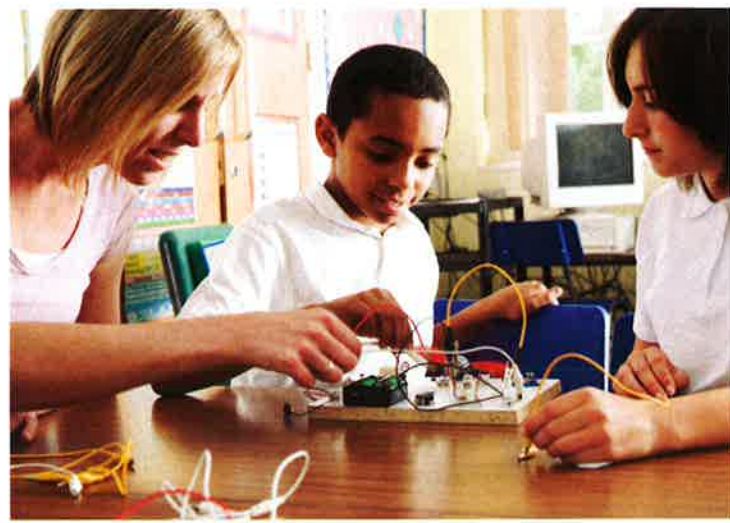
WHAT CAN YOU DO?

The NGSS open an exciting path in California, but **your voice is needed to realize their potential**. The State Board of Education will hear recommendations on the NGSS beginning in July and will vote on adoption no later than November 2013. The development of curriculum frameworks and instructional materials will follow, as will appropriate action to incorporate NGSS into the state's assessment and accountability systems. Further action and funding will be needed to help educators gain deeper content knowledge and new teaching strategies. This will take much work: business and community partners, policy makers, and education and parent leaders must collaborate and invest in the supports needed — such as professional development for educators, improvements in teacher preparation programs, access to laboratories and hands-on learning opportunities — to achieve the promise of the NGSS. To help ensure California moves boldly toward rigorous science education for its students, you can:

Education Leaders:

- * **Adopt plans to support educators** in meeting the expectations and demands of the NGSS, including professional development that is comprehensive and ongoing.
- * **Build partnerships across K-12, higher education and community programs** focused on preparing educators to teach STEM at all grade levels, including providing them with multiple and early opportunities for clinical practice in the classroom.

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- * **Reach out to local business and community leaders**, particularly those in the STEM fields, to develop partnerships that offer hands-on STEM learning opportunities to students.

Business Leaders:

- * **Tell policymakers, fellow business leaders, and the media** why adopting and implementing the NGSS will make a difference for your business and the state's economy.
- * **Create STEM partnerships with local schools** to contribute expertise, equipment, or hands-on learning experiences to connect students with STEM professionals — while building your future workforce.
- * **Encourage your employees** to find out how their local schools are preparing to implement NGSS and help them carry the message about the importance of the new standards for students educational and future success.

Parent and Community Leaders:

- * **Urge local education leaders** and policymakers to make NGSS adoption a high priority, and offer your support.
- * **Host events and use social media** to inform parents and community members about the importance of the NGSS to improving educational quality and opportunity for all students in your community.
- * **Tell your local media** how the NGSS are important to the future of your community.

To ensure you have the opportunity to be heard, you can receive e-mail alerts about hearing dates, agendas, and more from the California Department of Education by sending a blank email to: join-ngss@mlist.cde.ca.gov.

Science and Engineering Practices

NGSS integrates **eight major practices** scientists and engineers use to investigate and understand our world, and to build theories and solutions:

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

NGSS identifies **seven conceptual connections across disciplines**, and uses them to deepen students' overall scientific literacy:

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter in Systems
6. Structure and Function
7. Stability and Change of Systems



Three Dimensions of the Next Generation Science Standards

Disciplinary Core Ideas

NGSS emphasizes **deep understanding of the core ideas of science**, with progressive complexity across school years:

- * Physical Sciences
- * Life Sciences
- * Earth and Space Sciences
- * Engineering, Technology and Applications of Science

For further information about the development of the Next Generation Science Standards, visit the NGSS website at www.nextgenscience.org.

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¹The Next Generation Science Standards were developed by a consortium of 26 states including California, managed by Achieve in coordination with the National Academy of Sciences, the American Association for the Advancement of Science, and the National Science Teachers Association. See the NGSS at <http://www.nextgenscience.org>.

²Employment Projections Program, U.S. Department of Labor, U.S. Bureau of Labor Statistics, *Employment by Occupation*, BLS: 2009. http://www.bls.gov/emp/ep_table_102.htm.

³Carnevale, Anthony P., Nicole Smith, Michelle Melton, *STEM State Level Analysis*, Georgetown University, Center for Education and the Workforce, 2011.

⁴Based on 2011 National Assessment of Educational Progress fourth and eighth grade science and math scores.

⁵Dorph, R., P. Shields, J. Tiffany-Morales, A. Hartry, T. McCaffrey, *High Hopes — Few Opportunities: The Status of Elementary Science Education in California*, Sacramento, CA: The Center for the Future of Teaching and Learning at WestEd, 2011.

ABOUT THE ORGANIZATIONS

California STEM Learning Network's (CSLNet) mission is to prepare the nation's most STEM-capable graduates by coordinating and activating a multi-sector statewide network representing all STEM stakeholders. Through this cross-sector collaboration, CSLNet fosters innovation and helps to scale and sustain high-quality STEM teaching and learning for all students. Learn more at our website www.cslnet.org.

The Education Trust–West works for the high academic achievement of all students at all levels, pre-k through college. We expose opportunity and achievement gaps that separate students of color and low-income students from other youth, and we identify and advocate for the strategies that will forever close those gaps. See our website at www.edtrustwest.org.

Children Now is the leading nonpartisan, multi-issue research, policy development, and advocacy organization dedicated to promoting children's health and education in California and to creating national media policies that support child development. The organization also leads The Children's Movement of California. Get involved at www.childrennow.org.