



October 2020

# Governance Brief

## Supporting STEM Access, Equity, and Effectiveness

*Professional Learning is Essential to Next Generation Science Standards Implementation*

By Eric Hoyer

### Next Generation Science Standards Overview

The Next Generation Science Standards (NGSS) were adopted by the California State Board of Education in 2013. Since then, the state has adopted a curriculum framework (2016) and approved instructional materials (2018) to support this shift. The implementation of NGSS by local educational agencies (LEAs) has been uneven during these past seven years, with some districts leaping ahead of the fray and committing resources early on, but most choosing to wait for additional state guidance, funding, or both. Even for LEAs that can be considered early implementers, these instructional shifts are substantial changes that require new instructional materials, new supplies, space, and, most importantly, professional learning for educators. Not only does professional learning represent the cornerstone of preparing students for the standards, but it also is a process that takes a significant amount of time, often over multiple years. Teacher professional development is a substantial portion of a district's or county office of education's budget requiring travel, teacher release time, and often, support staff dedicated to professional development.

In this brief, governing board members will learn about the importance of professional learning, the types of learning involved in science instruction, and how best to support teachers and administrators shifting to the Next Generation Science Standards.

### The Importance of Professional Learning

Professional learning or professional development is essential to almost every profession. For K-12 teachers, professional learning allows educators to expand their

#### In this brief, you will find:

- » The importance of professional learning;
- » Types of professional learning available for science education;
- » Why administrators need to be included in professional learning;
- » How board members can prioritize professional learning; and
- » Questions for board members to consider.

skill sets, adapt to a changing student population, and align their lessons with new instructional standards. For LEAs that find it difficult to attract and retain STEM teachers, the professional learning that is offered may be critical to avoiding staffing shortages.<sup>1</sup> The Learning Policy Institute found that teacher preparation was a key factor in attrition and recommends, among other strategies, that greater investments be made in improving teacher conditions, including providing professional development time and opportunities.<sup>2</sup>

### Types of Professional Learning

Teacher professional learning comes in a variety of forms and board members may have different ideas about what constitutes professional learning. Long-term learning may include multiday learning sessions and professional learning communities, whereas medium- and short-term learning may include workshops and webinars, respectively.

As LEAs implement new curriculum standards such as NGSS, they must also provide professional development that is designed to assist teachers in making instructional shifts. NGSS contains significant changes from the former standards, moving from a focus on textbook learning and carrying out predetermined experiments to the development of student-generated science notebooks and the promotion of collaborative learning. Under NGSS, the teacher's role changes from being a "sage on the stage" to being a "guide on the side."<sup>3</sup> For example, a lesson might call for building a model bridge using various materials, requiring the students to determine the best method to do so. This work takes place in student groups with teachers asking questions and providing some guidance to help them find a solution, rather than a single "right" answer. Students document their successes and failures in their science notebooks and try to reason through why their methods did or did not work. In NGSS-aligned instruction, the previous norm of rote memorization of science vocabulary and experiments with one predetermined outcome are exceptions.

For teachers, as with students, learning how to learn is one of the more time-intensive aspects of professional development. Teachers are experiencing the lessons as students would and learning how to connect the lessons to the California Science Framework. In programs like the Elementary Science Academy at the San Diego County Office of Education (SDCOE), teachers are introduced to NGSS over an intensive four-day period, learning the science as students would. Teachers then periodically return to SDCOE over a series of several years, gaining and sharing knowledge with other teachers from the county. This process prepares "teacher leaders" who can bring knowledge back to their schools and serve as a resource for other teachers learning NGSS. CSBA featured this program in a recent video, which is available in the [resources section](#) of this brief.

Professional learning communities (PLCs) are another important way that educators can develop, reinforce, and scale up their professional knowledge by collaborating with paraprofessionals, teachers, and administrators. These are not just group meetings among educators but situations "when [they] reflect on their instructional practice, consider the effect instruction has on students, and implement insights gained from a meeting to improve their teaching performance."<sup>4</sup> PLCs are also a way to disseminate high-cost professional learning to a larger audience through knowledge sharing. They can bring rural or suburban educators together to benefit from professional learning without having to travel long distances to a major city. Finally, they are a community of educators who meet on a continuing basis

to update and improve their learning. PLCs allow educators to work out ideas and pilot lessons before introducing them into the classroom.

In shifting to NGSS, teachers need the longer-term professional learning experiences like those described above as well as other supports. Medium- and short-term professional learning activities should be used to supplement deeper experiences as teachers go from learning the standards to developing lessons and making the classroom more student-centered. As mentioned in a recent CSBA brief, [Shifting K-5 Science Instruction with NGSS Curriculum Adoption](#), county offices of education (COEs) are rolling out the CA NGSS Toolkit for Instructional Materials Evaluation (TIME), a set of resources designed to assist educators in evaluating science instructional materials along with training sessions on how to use them.<sup>5</sup> Importantly, teachers and administrators can make more effective decisions about materials when they have already had deeper training on NGSS.

Shorter and more easily accessible forms of professional learning such as webinars and tutorials are low-cost ways of obtaining additional training and usually can be scheduled at the learner's convenience, such as during a prep period, lunchtime, or after work. These are especially useful for reinforcing existing knowledge or learning how to make use of educational technology. It may be a textbook publisher illustrating a sample lesson or a company that enhances science lessons with gaming. For a teacher that is doing deeper professional learning on NGSS, these are ways to expand their teaching repertoire that do not involve a significant investment.

In sum, all three types of professional learning should be used for helping teachers transition to NGSS. A single, half-day workshop or participating in a webinar in isolation is insufficient. The Next Generation Science Standards represent a paradigm shift, and only with extended professional learning experiences will educators feel and demonstrate confidence in the classroom.

## Challenges of Professional Learning

### *Lack of Depth and Learner Loss*

Most professionals undergo some form of continuing education during their career, but their experiences vary in form and quality. Professional development might include a lunchtime webinar, a panel at a conference, or even an intensive multi-day course. However, research points to the efficacy of longer-term professional development where training includes "applications to practice" and

opportunities to “refine and apply their understanding of materials to their classrooms.”<sup>6</sup> While not every professional learning experience needs to be long term, it is important that teachers’ time is used in meaningful ways.

The depth of knowledge learned and transferability to the educator’s classroom are critical components of a quality professional learning experience. If the teacher finds it difficult to get started with implementing this new knowledge, they are likely to resist change and may revert to older methods or avoid the new subject altogether. German psychologist Hermann Ebbinghaus found that new information, not applied, is 75 percent forgotten after six days.<sup>7</sup> One way to counteract this “learner loss” is to make sure the participant has resources that are accessible after the training has ended. This could be a quick-start guide, the opportunity to consult with a coach or colleague, access to chat functionality for learner questions, or sample lessons that assist teachers with implementing this new learning.

### *Funding and Access*

The cost of professional learning can be considerable. One study found it can comprise as much as 10 percent of an LEA’s budget. The 50 largest districts in the United States are estimated to spend a total of \$8 billion per year on professional learning.<sup>8</sup> The components of professional development costs are training, travel, and hiring substitutes when professional development takes teachers away from the classroom during instructional time. Thus, while it can be an effective long-term learning method, multiday professional development opportunities can carry a considerable cost depending on the location and source. Although some training opportunities may have little or no direct cost, the expense of substitutes and the administrative effort to find them may still be substantial. In rural areas, where substitutes are in shorter supply, schools may attempt to outbid one another by offering a daily rate worth the teacher’s time to travel longer distance.<sup>9</sup> Some districts have resorted to employment services, with an increased cost, to find substitutes.<sup>10</sup>

One of the primary concerns with any teacher professional learning is access. This affects teachers and administrators in rural districts more acutely, as they may be hours from their local COE. Kern and Inyo counties, for example, cover twice the geographical area of Los Angeles County and have schools over 100 miles from their COE. COEs can be instrumental in providing professional learning, but a teacher facing a two-hour drive each way may be less likely to take advantage of professional development opportunities at the COE. Greenfield Unified School District in the Salinas Valley addressed this challenge by providing a hub in their district for professional learning given by the Monterey

COE staff, helping teachers avoid the one-hour commute to their county office. The increasing use of webinars and online meeting applications can also be used as a bridge to expand opportunities to small and rural districts.

### *Equity*

It is up to teachers to give students the confidence to succeed in science, but, much like the training needed to implement NGSS, teachers’ cultural proficiency may need bolstering. Addressing these challenges often requires equity training in addition to or along with science professional learning. To meet students where they are, teachers should have their own toolkits for addressing challenges faced by their pupils, particularly students with disabilities, students from low-income households, and/or students of color. Preconceived notions about which students are capable of rigorous work, students’ sense of alienation (“I don’t fit in to the smart kids’ group”), and relevance (“What is going on in the classroom doesn’t speak to me”) need to be addressed, especially with STEM subjects.<sup>11</sup> For additional support, the California Science Framework provides a chapter on access and equity, along with a chapter on professional learning.

### *Professional Learning in the Context of COVID-19*

During the COVID-19 pandemic, many districts and county offices of education are facing the additional challenge of providing high-quality professional learning in a distance learning context. Virtual professional learning networks present one option for LEAs. CDE guidance on distance learning approaches to professional development is included in the resources section at the end of this brief.

## **Administrator Professional Learning**

When a school board is considering its priorities with respect to professional learning, special attention should be paid to administrator needs with curriculum and instruction. As school leaders, principals should be empowering their teachers to experiment with NGSS lessons and new modes of learning. An administrator can be an effective advocate for science only if they have a working knowledge of the new standards and know what is expected of teachers. In a recent study of districts that implemented NGSS early, WestEd highlighted four recommendations that school and district leaders can implement when promoting NGSS:

- » Communicating that science is a priority school subject
- » Giving teachers flexibility to experiment with NGSS lessons, including those that integrate other subjects

- » Increasing both teacher-to-teacher and teacher-administrator collaboration around teaching science
- » Providing resources for science instruction

However, administrators cannot implement these changes without their own supports. WestEd’s “Early Implementer” districts supported principals in summer institutes and a Principal’s Academy where they learned how to support teachers who are going through professional learning.

One of the lessons that developers of the academy learned was that explicit “permission” from the principal empowers teacher leaders to feel free enough to experiment with lessons. When WestEd authors surveyed teacher leaders in this study, they found that 57 percent cited administrators who allowed them the “flexibility to try new things” as a “major factor” in their NGSS implementation.<sup>12</sup> As one sixth-grade teacher remarked in this study, “My principal doesn’t give you the feeling when she walks into your classroom that she is expecting to see a certain thing or that students need to be sitting this way or writing notes like this. NGSS is a little messy.”<sup>13</sup> While teachers run their own classroom, when they experiment, they often need a principal’s understanding, patience, and support.

Another role of a principal is to increase collaboration among educators. This could be within the school, within the LEA, or across LEAs. Setting up PLCs and workgroups is something a teacher may find daunting, but principals can be a networking resource to help organize PLCs. By making introductions and taking some of the organizational work out of PLCs, teachers can have more time to devote to their learning.

Additionally, principals can communicate that science is a priority for the school and articulate a vision for science instruction. A third-grade teacher in the aforementioned WestEd study said, “Our district is embracing science again. It is so motivating to both the teachers and students. The support of our district heads and administration is felt.”<sup>14</sup> While the communication comes from giving teachers time to collaborate and the resources they need, articulating a vision will require that principals have taken time to learn the standards, which requires their own professional learning.

One example of recent efforts for administrators is the Alameda County Office of Education’s “Principals Supporting NGSS,” a five-part module that uses resources developed by Alameda COE, WestEd, and the Lawrence Hall of Science. The modules focus on experiencing the standards, creating and realizing an equitable vision for science, building out the implementation of NGSS, and creating coherent learning across English Language Arts and Math Standards.<sup>15</sup>

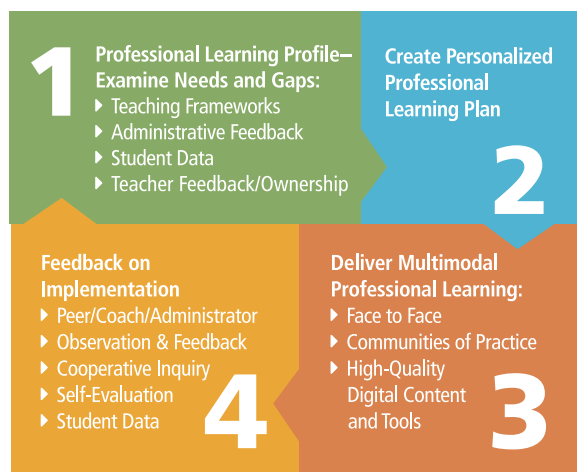
## Planning for Success

### *Institutionalizing Professional Learning*

Impactful professional learning involves training over multiple days, often with follow ups months and years later to reinforce and share experiences. Deep learning can also occur on daily basis through teacher support positions. To make NGSS professional learning happen in real time, trained staff on site would be necessary. While teachers need their own training, they also benefit from regular assistance and feedback on developing science lessons. One way to facilitate this is to have a teacher on special assignment (TOSA), science coach, or professional development coordinator work with teachers on their prep to develop material and to work alongside each other in the classroom to enhance science learning.

To facilitate professional learning, LEAs often will create a professional learning plan. This is helpful for mapping out needs, incorporating teacher feedback, developing accountability, and identifying resources. Long Beach Unified School District uses the following professional learning map (simplified below) along with a blog to detail their progress.<sup>16,17</sup>

**Figure 2:** Professional Learning Systems Map (adapted from Long Beach USD)



### *Statewide and Regional Partnerships*

It is often beneficial for a district’s approach to professional learning around NGSS to include the local county office of education and perhaps external partners like neighboring LEAs (especially in rural areas) or the closest California State University campus, as they are responsible for teacher education. Statewide and regional partnerships allow LEAs

to develop their own NGSS professional learning initiatives. The California Elementary Math and Science Initiative provided an \$8.8 million grant from the California Department of Education to California universities that helped develop programs around the state for K-5 STEM instruction. Using these funds, CSU Northridge developed a program, "Achieve Through PLCs." The program created PLCs with area elementary teachers and principals around NGSS that incorporated family engagement training. CSU Chico created "Project ESTEEM," which developed educator, community, and university partnerships in Northern CA over a two-year period. The teams developed and tested NGSS-aligned instructional units using a template from science faculty at CSU Chico.<sup>18</sup> Websites for both the Chico and Northridge projects are available in the resources section of this brief.

## Conclusion

For educators and administrators, moving to the Next Generation Science Standards is an exciting change but not without challenges. The primary way students will gain competency in NGSS is through teachers that have had deep professional learning that redefines the role of the teacher as a learning facilitator rather than a mere presenter. Board members should be aware of some of the additional challenges with providing professional learning that is meaningful and sustained. Furthermore, the resources needed to sustain a successful transition to NGSS will be significant and will need to be allocated over several years to ensure learning over time. Before an LEA considers instructional materials, lab space, science events, or other major investments, priority needs to be placed on teacher training. Fortunately, many LEAs are leading the charge on NGSS professional learning with excellent options available for educators. Board members can make NGSS professional learning a part of the LEA's future Local Control and Accountability Plan in order to allocate funds, communicate science's priority, and underscore that teachers are the key to its success.

## Questions for Board Members

- » What training on NGSS have teachers and administrators received since the standards were released? How comfortable are teachers with NGSS-aligned instruction?
- » What is the LEA's professional learning plan for the next three to five years? How does science fit into that plan?

- » Can the LEA develop or enhance positions around science, such as TOSAs, professional learning coordinators, or STEM coaches to support teacher professional learning on NGSS?
- » What are the equity gaps around science and STEM? Will teachers be receiving professional development in science need additional training to meet all students' needs?
- » What training is the county office of education offering on NGSS? Does the regional CSU or other regional university offer training, and if not, can something be developed?
- » How can the Local Control and Accountability Plan (LCAP) be updated to include NGSS implementation and the necessity of professional learning to accomplish this goal?

## Additional Resources

The CSBA STEM page [www.csba.org/stem](http://www.csba.org/stem)

WestEd's NGSS Early Implementers series  
<https://bit.ly/2DEGe7r>

The Achieve through PLCs page at CSU Northridge  
<https://bit.ly/33Dg1k9>

The Triad and ESTEEM Projects at CSU Chico  
<https://bit.ly/2P4I9aO>

Quality Professional Learning from a Distance, from the California Department of Education <https://bit.ly/3hgvQUF>

CSBA's Sample Board Policy 4131-Staff Development  
<https://simbli.eboardsolutions.com/Index.aspx?S=36030855>

Eric Hoyer is an independent education consultant and former Education Policy Analyst for the California School Boards Association.

## Endnotes

- 1 Sawchuk, S. (2017). 'STEM Deserts' in the Poorest Schools: How Can We Fix Them? Education Week. Retrieved from <https://bit.ly/33HRef2>
- 2 Darling-Hammond, L., Sutcher, L., & Carver-Thomas, D. (2018). *Teacher Shortages in California: Status, Sources, and Potential Solutions*. Learning Policy Institute. Retrieved from <https://bit.ly/2Lfdl16>
- 3 Workosky, C. (2018). *One District's Path to Improving Student Discourse*. National Science Teachers Association. Retrieved from <https://bit.ly/383WPIY>
- 4 Segura Pirtle, S. & Tobia, E. (2014). *Implementing Effective Professional Learning Communities*. SEDL Insights. Retrieved from <https://bit.ly/33NSAEW>
- 5 California School Boards Association. (2019). *Supporting STEM Access, Equity, and Effectiveness: Shifting K-5 Science Instruction with Next Generation Science Standards Curriculum Adoption*
- 6 Darling-Hammond, L., Hyle, M.E., & Gardner, M. (2017). *Effective Teacher Professional Development*. Learning Policy Institute. Retrieved from <https://bit.ly/363eTYD>
- 7 Glaveski, S. (2019). *Where Companies Go Wrong with Learning and Development*. Harvard Business Review. Retrieved from <https://bit.ly/2OMeUuv>
- 8 The New Teacher Project. (2015). *The Mirage: Confronting the Hard Truth about Teacher Development*. Retrieved from <https://bit.ly/2RfleLr>
- 9 S. Diaz, Glenn County Office of Education. (personal communication, April 4, 2019)
- 10 Courier-Post. (2018). *To fill substitute teacher void, rural school district turns to hiring service*. Retrieved from <https://bit.ly/2PfbCdA>
- 11 Lindsey, R.B., Nuri-Robins, K., Terrell, R.D., & Lindsey, D.B. (2019). *Cultural Proficiency: A Manual for School Leaders*. (pp. 188-9). Thousand Oaks, CA: Corwin.
- 12 Iveland, A., Tyler, B., Britton, T., Nguyen, K. & Schneider, S. (2017). *Administrators Matter in NGSS Implementation: How School and District Leaders are Making Science Happen*. WestEd. Retrieved from <https://bit.ly/2r9tF1n>
- 13 See Endnote 12.
- 14 See Endnote 12.
- 15 D. O'Connor, Alameda County Office of Education (personal communication, November 22, 2019)
- 16 Long Beach Unified School District. *myPD Systems Map*. Downloaded December 3, 2019 from <https://bit.ly/33HZQC7>
- 17 *MyPD: the Art and Science of Personalized Professional Development*. Downloaded December 3, 2019 from <https://bit.ly/2LiGDAQ>
- 18 California Department of Education. *CA Elementary Math and Science Initiative*. Downloaded December 3, 2019 from <https://bit.ly/33LqREI>

All data for this brief is based on a CSBA Analysis of: California Department of Education, California Assessment of Student Performance and Progress. 2018-19 California statewide research file. Retrieved on Oct. 9, 2019 from <http://bit.ly/2q2C0Tl>