K–12 District-Level Administrators: You Are Not Alone in the NGSS Universe

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Introduction

Science education has evolved significantly over the past several years, as the introduction of STEM education has introduced a more systemic and integrated approach to teaching science, technology, engineering, and math. The Next Generation Science Standards (NGSS) illustrate this new approach to science through the incorporation of scientific and engineering practices, crosscutting concepts, and disciplinary core ideas.

"The NGSS are based on A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (Framework) developed by the National Research Council (NRC)" (Bybee, 2013, p. xiii).

Administrators must use the framework and NGSS as they were designed and intended. The implementation must be structured and include specific core factors, including educator support, informed stakeholders, high-quality instructional materials, and effective systems (NGSS District Implementation Workbook, 2017).

This paper provides research, tips, and strategies that administrators can use to understand the NGSS, begin implementation of NGSS, and secure success in NGSS implementation.

Key Points Regarding Next Generation Science Standards

In 2012, the National Research Council proposed that an effective K-12 Science Framework should include practices, crosscutting concepts, and core ideas. These dimensions were meant to be incorporated into every discipline rather than taught in isolation.

Those who developed the NGSS acknowledge that scientific practices should be utilized when implementing them. The term "practices" emphasizes that "engaging in a scientific investigation requires not only skill but also knowledge that is specific to each practice" (Rybee, 2013, xv). These practices include various tools and techniques and are not limited just to scientific inquiry. This expands the teaching strategies that can be used in instruction.

Ideally, today's science education will move away from old teaching patterns that limited student inquiry. NGSS-focused teachers will pose fewer questions with only one right answer, distribute fewer worksheets, refrain from asking students to simply read the textbook and answer questions, and stop simplifying activities for students that are perceived to be less capable.

With implementation of NGSS, science education will involve more systems thinking and modeling, investigations, open-ended questions, students completing tasks that offer explanations and arguments, and support to students if it is needed (National Research Council, 2015).

NGSS includes three dimensions of learning:

1) Science and Engineering Practices: "behaviors that scientists use to answer questions and engineers use to solve problems in the real world" (Yan, 2017)
2) Crosscutting Concepts: "concepts apply across all behaviors and functions… connect the ideas from different scientific disciplines" (Yan, 2017)
3) Disciplinary Core Ideas: "content knowledge including Life Science, Physical Science, Earth & Space Science, and Engineering & Technology (Yan, 2017)

The practices defined by the NRC should be taught to students in process form. When a step-by-step procedure is defined for each practice, students can more easily apply the practice to any discipline. This enables coordination of knowledge and skill.

The crosscutting concepts defined by the NRC may be applied across all science domains. "The crosscutting concepts are the themes or concepts that bridge the engineering, physical, life, and Earth/space sciences" (Pratt & Rybee, 2013).

The disciplinary core ideas are designed "to prepare students with sufficient core knowledge so that they can later acquire additional information on their own" (Pratt & Rybee, 2013). Students develop their ability to find and use appropriate resources rather than being given the information in a direct instruction manner.

While it is preferable to incorporate the three-dimensional NGSS approach, it is acceptable to work toward this approach over time. However, teachers should understand up front that the goal is to incorporate all three dimensions for total integration.

"It's important to help students develop scientific literacy through the use of phenomena … to develop scientific literacy for students … [and] bring the NGSS goals into the classroom while also following state standards" (Yan, 2017).

Tips for Incorporating NGSS into Your Current Curriculum

The K-12 Science Framework should guide the decisions necessary for implementing the NGSS into your current curriculum.

The National Research Council (2015) outlines seven principles that reflect this vision:

1) Ensure coherence across the state, district, and schools
2) Encourage teachers to emphasize the uniqueness of science
3) Develop and provide continuing professional development at all levels
4) Build relationships and partnerships
5) Take the time to implement the NGSS properly
6) Make equity a priority
7) Make communication a priority

These principles support the vision by arranging standards so elementary through high school students have many chances to build on prior knowledge. Scaffolding is an essential requirement for incorporating NGSS into the curriculum and classroom. Some scaffolding strategies include:

1) Offering a context clue to help students remember prior knowledge;
2) breaking a complex task into smaller tasks;
3) providing students with an example of the desired outcome or product;
4) using verbal clues to prompt answers;

5) facilitating student engagement and participation;

6) modeling an activity; and

7) guiding students through a task similar to one completed before (Lewis, n.d.).

Major elements to consider for implementation include recommendations in instruction; professional development; curriculum resources; assessment; collaboration, networks, and partnerships; and policies and communication (National Research Council, 2015). Successful implementation requires a systemic approach.

INSTRUCTION
Communicate and support a vision consistent with implementation of the NGSS
Support teachers in making changes to their instructional techniques
Help principals and teachers create and develop a classroom culture that supports the new vision
Embed assessment into the instruction itself
TEACHER AND LEADER TRAINING
Create implementation teams that include all levels of employees (e.g., paraprofessionals, teachers, administrators)
Create a multi-year plan for professional development and implementation
Create and deliver professional development that is content specific; related and modeled to the teacher's desired instructional practices; demonstrates reflective collaboration; and includes a support system
Leverage partnerships
CURRICULUM MATERIALS
Do not rush to replace all current materials. Rather revise these materials as possible
Plan a proper scope and sequence to incorporate implementation of NGSS
Use clear measures to evaluate possible new materials
Curriculum materials should be evaluated for scaffolding opportunities in future grade levels
ASSESSMENT
Create a new system of assessment that incorporates multiple assessments including tests, classroom-embedded assessments and district/state-level assessments
Help teachers develop appropriate formative assessments
COLLABORATION, NETWORKS & PARTNERSHIPS
Create opportunities for collaboration
Identify, participate in, and build networks
Cultivate partnerships
POLICY & COMMUNICATION
Ensure existing policies are consistent with NGSS implementation
Create realistic timelines and monitor progress against determined performance measures
Use the K–12 Framework to drive teacher preparation at the college level
Communicate with local stakeholders

(National Research Council, 2015)

District-Level Administrator Responsibilities

The following steps should be taken once you have decided to proceed with NGSS implementation:

1. Determine How NGSS Fits Your District's Vision

You must have a clear understanding of the NGSS before proceeding, so you can frame your vision for implementing NGSS within the district. Some important questions must be answered:

- Who has the authority to adopt standards?
- What is the vision or end goal?
- When do you want to start implementation?
- When do you expect to be able to bring NGSS to all classrooms?
- What financial support will you receive from the district and/or state to plan and execute implementation of the plan?
- What professional development will be provided?
- How will you fund the additional resources and professional development needed for the classroom?
- Who will support the plan for implementing NGSS in the district? (NGSS Adoption and Implementation Workbook, n.d.)

The answers to these questions may help you determine if it is the right time to address NGSS implementation in your district. If the necessary support is not available at the time, you may need to regroup. A more structured approach, for instance one that presents positive results from other districts, may be helpful. Providing background research and citing relevant resources can help you garner more support from stakeholders.

2. Review System Capacity

Before you implement broad changes, you should assess your needs and create a budget. To minimize cost, determine which resources you currently have in place that can be used throughout the implementation. If there are gaps, you must determine how to fill them. Funding needs and availability will have to be established, including the research needed to find outside funds, such as grants. Shore up the networks and partnerships you depend on for in-kind donations.

3. Identify Your Leadership Team

Who will be involved with planning and implementing NGSS within the district? A district-level administrator plays an integral role in implementing NGSS within a school district, but ownership of this plan lies at many different levels. As the number of stakeholders involved rises, so does the potential for problems. Therefore, the selection of members for the leadership team is critical. Ideally, you will select representatives from different areas of content area instruction, district administrators (e.g., special education, ELL, assessment, curriculum and instruction), legislature, parents, teachers, school administrators, and other community stakeholders (NGSS Adoption and Implementation Workbook, n.d.).

4. Create an Effective System for Professional Development

This system should support teachers as well as school-level administrators. Include district-level staff in developing the system, so you can utilize the resources you already have in place. Open the lines of communication to ensure that everyone is involved in the process to minimize future issues.

5. Involve Parents and Stakeholders

Once the plan has been fully developed, it is time to bring in parents and stakeholders. Maintaining continual communication can help you garner the support needed once NGSS has reached the classroom. You can maximize the strengths of these groups to increase the level of support and potentially increase available resources.

6. Evaluate Instructional Materials

Determine which instructional materials will be needed to fully bring NGSS to the classrooms. Evaluate the current resources available and inventory those that are in alignment with NGSS. Don't buy instructional materials if it isn't necessary. Consider "hiring" teachers to modify current curriculum so that it is in alignment with NGSS. Utilize your content area systems (since they are the most familiar with your instructional materials) as well as the student population.

7. Develop Appropriate Assessments

Refer back to the recommendations provided above. Alternative assessments and formative assessments are a key element of an NGSS curriculum. Teachers may need professional development around creating rubrics and project-based learning experiences. People within your district that are already displaying excellence in instruction and assessment should be utilized when possible. Make sure they are compensated appropriately.

8. Create A Prototype or Model

To begin implementation, select a school or grade-level where you know you will find supportive building personnel, and use it as a model. This will help ensure that you have worked out problems before you roll out your plan too far and too fast.

9. Evaluate Your Progress

Learn from mistakes and adjust as you go. Keep growing and expanding on your model until you reach full implementation.

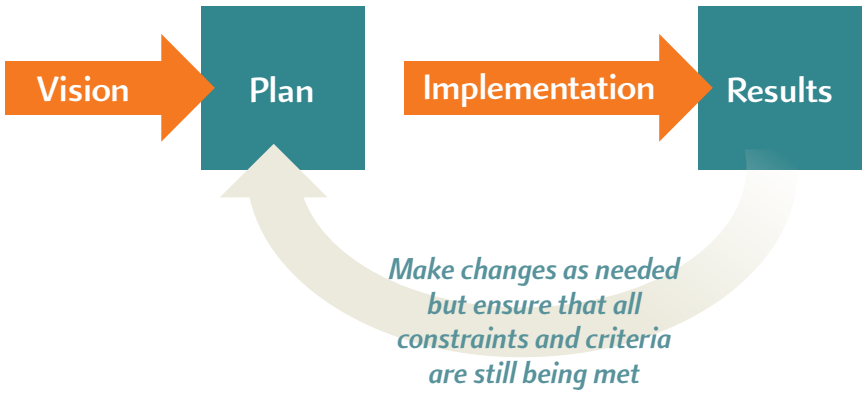
Summary

As administrators begin implementing NGSS within their schools, there are common pitfalls that should be avoided. Administrators should not expect instruction to change overnight. Teachers should not be expected to implement NGSS in their classrooms without support.

Furthermore, administrators should not be so focused on standards that they forget the broad focus of NGSS. For example, never walk into a classroom and ask, "Which standard are you teaching today?" Instead, the focus should be on the practices in the lesson plan.

Administrators must also communicate with parents and the community to garner support. This ongoing communication should include regular updates and efforts to educate all stakeholders on the implementation process itself (National Research Council, 2015).

As you work through the process of implementation, remember the general premise behind engineering design. Create a plan. Execute the plan. Evaluate the results and determine if optimal results were achieved. If results are not optimal, revisit the plan (ensuring that constraints and criteria are still being met) and go through the cycle again.



NGSS can help K–12 students learn and experience science in deeper ways by developing key skills such as communication, collaboration, inquiry, problem-solving, and flexibility. How NGSS is implemented will have a significant impact on whether those skills are taught successfully.

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