



PLT and the Next Generation Science Standards: Built on a Common Foundation

In today's science- and technology-based society, it is vital that all students have access to a high-quality science education that provides them with the skills and knowledge they need to be well-informed citizens, to be prepared for college and careers, and to understand, appreciate, and apply scientific practices. The Next Generation Science Standards (NGSS) reflect a new vision that is designed to meet these goals. Project Learning Tree (PLT) recommends the adoption and implementation of NGSS as an effective and research-based approach to transform science education and work toward accomplishing these goals.¹

PLT is built on many of the same guiding principles as NGSS. This paper discusses some of the major shifts within NGSS, along with the many ways in which PLT supports NGSS.

PLT and NGSS Shared Foundational Principles

- Both emphasize the integration of science content knowledge with its application.
- Both use cross-cutting concepts as a way for students to link concepts from different fields.
- Both place an importance on the interconnected nature of science as it is practiced and experienced in the real world.
- Both emphasize the importance of students using scientific practices to help them apply what they are learning.
- Both promote the development of scientifically literate citizens through interdisciplinary, hands-on learning.
- Both include connections to Common Core English Language Arts and Mathematics standards to develop future scientists and citizens who can understand, communicate, and participate in science and environmental issues.
- Both have a strong focus on professional development as a key to successful program implementation.

¹ National Science Teachers Association Position Statement: The Next Generation Science Standards <http://www.nsta.org/about/positions/ngss.aspx>. Accessed 07/29/2014.

I. Focus on Both Knowing and Doing

The Next Generation Science Standards state the science and engineering competencies that all students should be able to demonstrate at sequential stages in their K-12 education. One of the important changes in the new science standards is the emphasis on integrating science content *with* application.

This represents a shift in emphasis from a broad array of content to a focused integration of science concepts and practices. NGSS identifies Disciplinary Core Ideas (DCIs) detailing the content, as well as Science and Engineering Practices describing what students should be able to do. Each NGSS Performance Expectation (standard) incorporates these two elements, and makes clear what students are expected to *know* and be able to *do* to demonstrate that they have met the standard.

Because the new science standards emphasize not only what students are to *know* about



science, but also what they are to be able to *do*, it is crucial that educators have materials that address both of these needs. PLT's materials meet this requirement by guiding the learner through the process of awareness, understanding, challenge, motivation, and action through hands-on investigations and active involvement. PLT's activities include content and application, as well as assessment opportunities in which students are asked to apply and demonstrate what they have learned.

For example, "Forest Invaders" from the high school module [Exploring Environmental Issues: Focus on Forests](#), addresses performance expectation HS-LS2-7 in a number of ways. This performance expectation specifies that students should be able to design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. In the PLT activity, students discuss why invasive species might be a problem for forest ecosystems, read about different types of invasive species, learn about the various technologies that can be used to control invasive Gypsy Moths, and try to persuade others that one of the control methods is superior. In the final part of the activity, students select an invasive plant or animal threatening their community and develop a presentation to inform others about the species and how to prevent its spread. As enrichment, students are encouraged to take action by participating in an invasive species control project. As this activity demonstrates, PLT materials move students beyond content *knowledge* to *application* in an integrated context.

NGSS Performance Expectation

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

[Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

II. The Importance of Cross-Disciplinary Learning

NGSS includes seven Crosscutting Concepts that provide students with connections that are related across the four different science domains: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of sciences. By bridging the different science disciplines, the Crosscutting Concepts allow students to connect different pieces of knowledge. This helps students deepen their understanding of the Disciplinary Core Ideas.

PLT's Conceptual Framework was also designed to link concepts from different fields to deepen students' understanding of science and the environment. PLT's Conceptual Framework serves as the basis for the development of all of its curriculum materials.

There are many commonalities among the PLT Conceptual Framework themes and NGSS Crosscutting Concepts. Following is a list of NGSS Crosscutting Concepts and PLT Conceptual Framework Themes with areas of concept overlap identified:

NGSS 7 Crosscutting Concepts:

Patterns

Cause and Effect

Scale, Proportion, and Quantity

Systems and System Models

Structure and Function

Stability and **Change**

Energy and Matter

PLT 5 Conceptual Framework Themes:

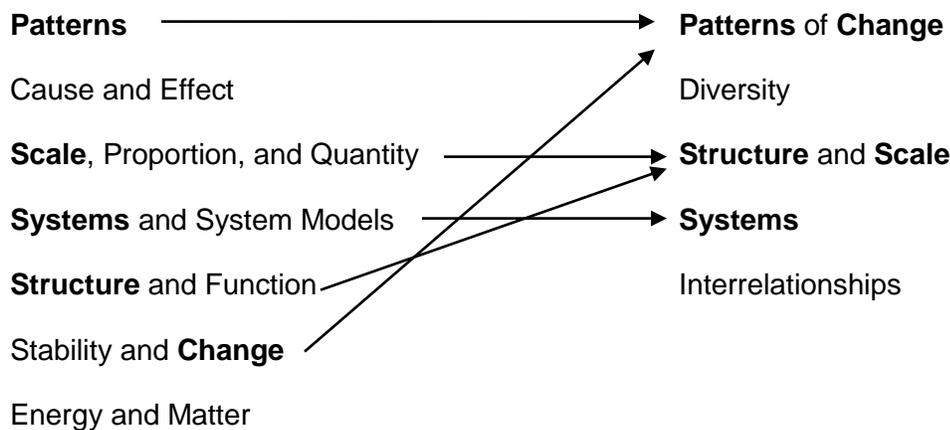
Patterns of Change

Diversity

Structure and Scale

Systems

Interrelationships



It is important for students to recognize these concepts because they are common to so many areas of science and engineering. The more students become familiar with them, the more prepared they will be to develop a scientifically based view of the world and to help solve environmental issues.

PLT activities help students see connections among cross-cutting concepts and core disciplinary ideas through real-world investigation and problem-solving. For example, by conducting a check-up of trees in their neighborhood in [PLT's PreK-8 Environmental Education Activity Guide](#) activity "Trees in Trouble" (activity 77), students explore the concept of cause and effect, while also learning about the core idea of growth and development in organisms. In the PLT activity "Nature's Recyclers" (activity 24), teams of students devise experiments using sow bugs, through which they learn first-hand about the cycling of energy and matter in ecosystems.

PLT's *PreK-8 Activity Guide* is organized by the Conceptual Framework themes. This organizes the Guide's 96 activities into five sections, making it easy for educators to connect a series of

activities into an instructional unit. This allows for a deeper exploration of each theme, which increases students' understanding of the concepts being taught. To view PLT's complete Conceptual Framework, visit the [PLT website](#).

III. Interconnected Nature of Science

NGSS states that science education should reflect the interconnected nature of science as it is practiced and experienced in the real world.² NGSS recommends that students actively engage in scientific and engineering practices and apply crosscutting concepts to increase their understanding of core concepts in these disciplines. This recommendation that students engage in science learning at the nexus of the three dimensions of science and engineering practices, crosscutting concepts, and disciplinary core ideas, is one of the most significant shifts in NGSS.³



PLT activities are interdisciplinary by design and help students experience the interconnected nature of science through hands-on investigations. For example, in PLT's [GreenSchools! Investigation](#), "School Site," students combine knowledge and skills from both science and engineering as they collect data on the habitats, wildlife,

trees, and ground cover on their school site. During one part of the investigation, students learn about pervious and impervious ground cover, discover why pervious ground cover is important, and determine if the amount of pervious ground cover on their school site should be increased. Students then explore design solutions to increase the amount of pervious ground cover. Through just this one activity, students learn many science concepts and discover how engineering practices can be applied to solving a problem on their school grounds. They also are exposed to many of the crosscutting concepts, including: Patterns, Cause and Effect; Scale, Proportion, and Quantity; Systems and System Models; and Stability and Change.

² Next Generation Science Standards, Appendix A. <http://nextgenscience.org/>. Accessed on 07/29/2014.

³ National Science Teachers Association Position Statement: The Next Generation Science Standards <http://www.nsta.org/about/positions/ngss.aspx>. Accessed on 07/29/2014.

IV. Content Depth and Application

Another conceptual shift in NGSS is the emphasis on a deeper understanding of content, as well as the application of content.⁴ Also new to the standards is the emphasis on the importance of students engaging in scientific practices *directly*, not learning about science secondhand. PLT activities support these NGSS changes in many ways. First, PLT activities can be grouped together into a unit, allowing students to delve deeper into a topic area. Educators can quickly find activities in PLT’s *PreK-8 Guide* to build a unit using the “Storylines” provided in Appendix 3, the “Topic Index” found in Index 5, or the “Related PLT Activities” listed in the sidebar of each activity. PLT’s secondary modules each focus on a specific topic, such as forest ecology or biodiversity. These modules promote a greater depth of understanding and allow opportunities for students to apply what they’ve learned.

Secondly, PLT lessons engage students in scientific practices through hands-on activities, such as field investigations, experiments, data collection and analysis, debates, role play, and problem solving. These activities help students delve deeper into content and see the application of what they’re learning.

In addition, PLT provides authentic assessment ideas for all of its activities. These assessments require students to apply and demonstrate what they’ve learned, rather than to simply state what they’ve learned.

For instance, PLT’s “Water Wonders” and “Every Drop Counts” activity from the *PreK-8 Guide* can be grouped together to support content depth and application when learning about the water cycle and water conservation. In “Water Wonders” students play a game and conduct an experiment to learn about the water cycle, its importance to living things, and how plants affect the movement

PLT’s “Water Wonders” and “Every Drop Counts” Support NGSS Performance Expectations

5-ESS2-2: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

of water in a watershed. They also learn about the amount and percentages of water in various reservoirs, such as oceans, ice caps, and lakes. In “Every Drop Counts” students monitor how much water they use in a day, describe how water is wasted and why it’s important to conserve it, and then design, implement, and evaluate a water conservation plan. PLT includes four different authentic assessment ideas for these activities that require students to apply and demonstrate what they’ve learned.

⁴ Next Generation Science Standards, Appendix A. <http://nextgenscience.org/>. Accessed on 07/29/2014.

To extend the learning further, students could conduct PLT's [GreenSchools! Investigation](#) on Water. Through this Investigation, students assess the source, cost, and quality of their school's water supply, and then brainstorm and recommend ways to enhance current water conservation practices. Student leaders, along with administrators, are encouraged to implement one or more of their recommendations.

V. Scientifically Literate Citizens

NGSS supports the development of the next generation of decision-makers who will help solve the many science and technology challenges that face society today. NGSS indicates that a scientifically literate person *understands* the core ideas in each of the major science disciplines and is able to *apply* them. This emphasis is aligned with PLT's mission to develop environmentally literate citizens.

PLT's Mission

PLT advances environmental literacy and promotes stewardship through excellence in environmental education, professional development, and curriculum resources that use trees and forests as windows on the world. The Sustainable Forestry Initiative® Inc. is a sustainability leader that stands for future forests. PLT is an initiative of SFI.

PLT's materials engage students in hands-on, interdisciplinary activities that are designed not only to teach science concepts, but also to develop problem-solving skills and apply them to environmental issues. This process of applying science concepts to solve real-world problems is important to developing a responsible environmental citizenry.

Through PLT activities, students learn how to *apply* scientific processes and higher order thinking skills to address local, regional, and global environmental issues. They also learn *why* it is important to protect the environment through activities such as recycling, water conservation, and energy use reduction.

In PLT's [GreenSchools! Investigation](#) on energy, for example, students learn about renewable and nonrenewable energy resources, determine the primary source of energy for their school, and discover why it's important to conserve energy. Through observation, surveys, and the use of monitoring equipment, students collect data about their school's energy consumption, and then make energy conservation recommendations for their school. Finally, students are encouraged (and possibly even supported through PLT's mini grants) to implement one or more of their recommendations and share their findings with others.

VI. Alignment with Common Core

NGSS stresses the need for scientifically literate students to be able to communicate their understanding of science. Students must be able to read and understand science procedures and protocols, as well as effectively communicate their predictions, results, and conclusions. They also need to be able to read and comprehend science issues in the news and other forms of mass media. To support this understanding of informational text, each NGSS standard includes

connections to the Common Core State Standards for English Language Arts and for Mathematics.

PLT activities are multidisciplinary and support the integration of science, language arts, and mathematics. Most of PLT's activities include student pages, which engage students in activities such as informational and close reading, argumentation, and analyzing and interpreting data. In addition, in many of PLT's activities, students are asked to conduct research, prepare and give presentations, or debate various viewpoints. These tasks help students build skills in English Language Arts and Mathematics. A correlation of PLT's *PreK-8 Activity Guide* to the Common Core State Standards [can be found online](#).

VII. Professional Development Supports Implementation

Professional development that is aligned with NGSS is critical to the success of adopting and implementing the new standards. Brian Reiser from Learning Sciences at Northwestern University noted in his recent paper that a strong focus on professional development is a key to implementing NGSS.⁵

PLT has always had a strong emphasis on professional development. Since its beginning, PLT has provided professional development opportunities to educators across the country through its state network of coordinators. Each year, approximately 25,000 educators receive PLT training through onsite workshops, and to date, more than half a million educators have been trained. In 2015, PLT will launch a new online professional development program in order to reach new audiences and support blended learning. PLT training and workshop opportunities for educators throughout the U.S. can be found online at [PLT Professional Development Calendar](#).

VIII. Next Generation of PLT Materials

PLT remains the cornerstone of environmental education because of its commitment to continuous improvement. PLT is currently in the midst of a 3-year plan to revise its [PreK-8 Environmental Education Activity Guide](#) so that it may continue to adequately sustain, support, and engage the next generation of teachers and learners.

To guide this work, PLT has established a Next Generation PLT Advisory Committee comprised of highly dedicated field experts. Following a series of conference calls, members representing university faculty, conservation educators, classroom teachers, and nonprofit partners from 15 states, met in July of 2013 to review PLT's existing curriculum materials and to share their future vision of PLT.

⁵ What Professional Development Strategies Are Needed for Successful Implementation of the Next Generation Science Standards? By Brian J. Reiser <http://www.k12center.org/rsc/pdf/reiser.pdf> Accessed on 07/29/2014.

Focal points for the Next Generation PLT Advisory Committee include creating topical units, increasing rigor and assessments, and building 21st century skills such as problem solving and teamwork using investigative, student-led learning. Jaclyn Stallard from the national PLT office remarks, "PLT's "Next Generation" of environmental education materials will demonstrate PLT's ability to meet teachers' needs and to show alignment with current education trends, while also benefitting the most important part of the education equation: the student." The release of new PLT program materials is expected in early 2016. Please visit www.plt.org for progress updates on the development and release of the new materials.

We hope that this paper has helped you discover ways that PLT can be used to meet many of the components of NGSS. If you would like to share your thoughts and comments on this paper, please email the National PLT staff at information@plt.org.