

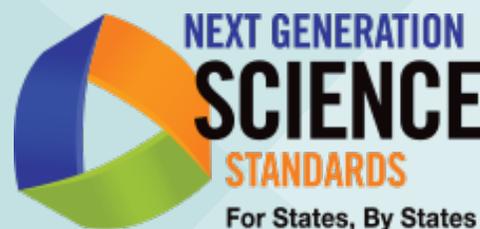


Next Generation Science Standards (NGSS): Opening the Possibilities for Deeper Learning and Assessment

WHITE PAPER

OVERVIEW

This white paper outlines approaches to the teaching of science based on the NGSS, as well as an overview of some of the challenges. It also provides an orientation to some helpful content and technology resources and offers recommendations for easing the challenges of NGSS assessments, including building device and delivery system-agnostic digital content based on open standards (QTI 2.X, APIP, and QTI-PCI). This in turn facilitates use across the educational environment, allows easy integration with existing QTI content libraries, and simplifies the delivery of content to students across multiple devices



INTRODUCTION

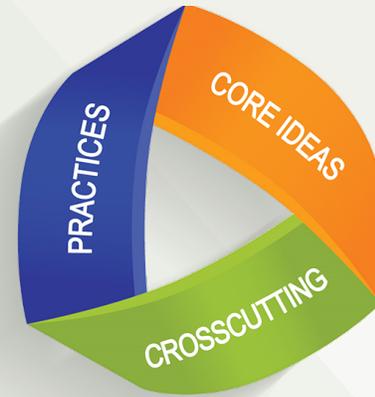
The Next Generation Science Standards (NGSS) adopted in the US by 18 states and the District of Columbia (DC) significantly change the expectations for the way in which students learn, as well as how they are assessed in science. Even states not adopting the NGSS are moving towards science content standards that are influenced by the NGSS or are considering using assessments that are stylistically similar to those needed to measure mastery of the NGSS.

The NGSS make it clear that it is no longer sufficient for students to simply demonstrate their ability to regurgitate facts, follow directions, and solve routine problems. The rigor of the content standards requires students to demonstrate evidence of deeper learning as well as mastery of Performance Expectations (PEs) that integrate Three-Dimensional Learning (3DL). The three dimensions are:

Dimension 1: Scientific and Engineering Practices (SEPs)

Dimension 2: Disciplinary Core Ideas (DCIs)

Dimension 3: Cross Cutting Concepts (CCCs)



The expectation is that during their science education, students will be immersed in scientific practices, construct meaning, learn core ideas, and make connections to universal science concepts. This will prepare them to thrive in a world that increasingly utilizes science and technology in the workplace and in everyday life.

As a result of the changes in science standards, classroom learning and assessments are poised for significant changes. Students will need exposure to deeper learning experiences, performance-based activities, relatively complex classroom assessments, and individual feedback in order to help them progress on their learning path. However, this will demand much from educators.

It's complex and challenging to design and provide scientific experiences that incorporate multiple components and utilize scaffolding to help students of all abilities enter and progress along the path of learning and understanding.

Educators will require professional development opportunities to help them adapt their daily practices, shift instruction from focusing on facts to explaining phenomena¹, and gain access to effective learning tools and resources aligned to new science standards.

CHALLENGES FOR IMPLEMENTING THE NGSS

It's clear that developing, administering, scoring, and interpreting NGSS assessments will be challenging.

The recommendations of the National Research Council of the National Academies² are to:

- Include multiple components
- Measure the continuum of learning
- Provide data that helps teachers determine appropriate next steps

We can expect that NGSS-driven formative and summative assessments will include multi-part online tasks with stimuli shared across items. That is, task-based stimuli and artifacts such as images, simulations, video files, etc., will serve as the informational resources that support a cluster of assessment items of various types.

Item types such as evidence based selected-response (EBSR), short-response (SR) constructed-response (CR), and Technology Enhanced Items (TEIs) will all have a part to play in measuring the range of student proficiency.

Understandably, U.S. states, assessment-giving organizations, and educators will need access to cost-effective, user-friendly tools and resources in order to develop these kinds of tasks.

HELPFUL RESOURCES

Content Resources

To alleviate some of the burden, a few organizations have begun to create and make available prototype NGSS tasks. For example:

- **Achieve** offers a set of classroom tasks for middle and high school science, in PDF and Word formats, with links to online resources.
- **The NGSA Collaborative's** website has draft tasks available for middle school science. These can be accessed individually, and responses to CR items can be entered.
- **CCSSO's Science Assessment Collaborative** in conjunction with WestEd offers an assessment framework and prototype items for grade 5 and high school.

Technology Resources

The ability to leverage the power of technology to develop and distribute assessments will facilitate the transition to an NGSS-driven environment.

Effective technology-driven assessments can provide the visual vibrancy to quickly and effectively engage students in deeper learning experiences, capture data that measures student mastery of PEs, and provide actionable reports to guide personalized learning.

Technology can also facilitate the sharing of content, assessment, and data when it is built in accordance to open standards, thus enabling integration with existing digital environments.

Assessment Platform Resources

Open Assessment Technologies (OAT) is already known on the global stage for leveraging open source and open standards to provide new ways for digital learning and assessment. At OAT, we are committed to redefining digital assessment and easing the transition of organizations as they leverage technology to integrate assessment and learning.

Currently operating at the forefront of NGSS solutions, we support our clients in implementing their approach to Next Generation science education by empowering them with the tools to create innovative, interoperable content and assessments and by providing research-based and field-tested advice and solutions.

Our recommendations for NGSS assessments include building device and delivery system agnostic digital content based on open standards (QTI 2.X, APIP, and QTI-PCI). This facilitates their use across the educational environment, allows easy integration with existing QTI content libraries, and simplifies the delivery of content to students across multiple devices.

1. Reiser, Brian J., What Professional Development Strategies are Needed for Successful Implementation of the Next Generation Science Standards, Paper Presented at the Invitational Research Symposium on Science Assessment, K-12 Center of ETS, 2013
2. National Research Council of the NGSS: Developing Assessments for the NGSS, 2014

Assessment Platform Resources

- The TAO Community Edition, is an open source assessment platform available as a free download at www.taotesting.com and is **compliant with key open standards** such as **QTI, PCI, LTI, Math ML, and Open ID**. TAO provides flexibility and interoperability across all assessment components to support the implementation of the NGSS (and other content area standards as well). Since the underlying software is open source, you to retain ownership of all the content you create.
- A key component of TAO is the **Item Authoring module**, which facilitates the development of online performance tasks as part of an immersive environment for science education. This is one of the reasons that clients such as the state of Illinois chose TAO.
- Once you are ready to engage teachers in professional development activities, like collaborating on the development of NGSS tasks, reviewing tasks and items in the Item Bank, or creating tests, then you can use the **TAO Online Delivery module** to deploy content and assessments across your organization.
- Lastly, using the **TAO Results Reporting module**, you'll be able to analyze data on individual or groups of students.
- Should you need assistance, you can choose from TAO's menu of services from integration, customization, TAO Cloud hosting, training, and support, as well as the option of having a TAO Enterprise Edition configured to your specifications.



As a best practice, users should phase in their approach to NGSS implementation by first using the TAO Item Authoring/Item Banking module, as its built-in features make it a simple process to create QTI test items.

The TAO Item Authoring/Item Banking module also makes it easy to integrate Technology-Enhanced items using QTI-PCI. And to support the tenets of the NGSS, it allows for the development or integration of stimuli and the inclusion of images, audio and video files, all of which can be shared across a set of items that make up performance tasks.

NEXT STEPS

The NGSS by their nature are driving significant changes in learning and assessment. Leveraging technology to design, create, and integrate assessments with the content and sequence of learning will help put students on the path to mastering performance expectations in science and to becoming effective contributors to the global community.

At Open Assessment Technologies, our job is to make yours easier.

Find out how to utilize TAO technology to engage students in deeper learning and to deliver assessments online by signing up for one of our weekly demos or contact us directly to schedule a deeper look at the TAO platform and to discuss your specific needs.

ADDITIONAL RESOURCES FROM TAO



ABOUT OAT

TAO, from Open Assessment Technologies, is the leading digital assessment solution for education and career advancement. Modular, customizable and interoperable by design, TAO empowers you to break free from the confines of proprietary silos, eliminate expensive licensing fees, take full control of your testing resources

PRODUCT

ACCELERATING INNOVATION IN DIGITAL ASSESSMENT

Three TAO editions, one powerful platform. Download our product sheet to learn more about TAO's digital assessment platform solutions for assessment authoring, delivery, rostering and reporting and find the product tier that's right for your organization.



CASE STUDIES

- **Transitioning an Item Bank from Paper to Digital with The Finnish Matriculation Examination Board (MEB)**
- **TAO Addresses the Unique Assessment Needs of Students with Cognitive Disabilities**
- **Beyond Multiple Choice: UMass Enriches Adult Proficiency Tests with Engaging Interactions Types Using TAO**
- **The Swiss Conference of Cantonal Ministry of Education (EDK) Uses TAO to Ensure Consistent Nationwide Learning Standards**
- **New York City Department of Education (NYCDOE) Adds Technology and Multimedia to Language Proficiency Exams**
- **The Comenius Program in Europe Uses TAO to Deliver Self-Assessment Surveys to At-Risk Youth**
- **Elsevier Incorporates TAO with Ease, Gauging Career Readiness in Healthcare Fields**



WHITE PAPERS

- **Next Generation Science Standards (NGSS): Opening the Possibilities for Deeper Learning and Assessment**
- **Redefining Digital Assessment**
- **The Importance of IMS Certification and QTI Compliance**
- **The Practical Guide to Successful Large-Scale Online Assessment**
- **Three Tangible Ideas for Engaging Assessment Content**

eBOOKS

- **The Practical Guide to Digital Assessment**