OpenSciEd Middle School Curriculum

OpenSciEd fosters a classroom culture where everyone matters and is heard. OpenSciEd's curriculum is engineered to be engaging and collaborative, utilizing the unique skill sets of educators and students, so that everyone can feel more inspired in their education journey. Through the collaborative efforts of a national network of state science leaders, curriculum developers, learning scientists, teachers, and students, OpenSciEd was able to create a research-based, freely available, NGSS-aligned science curriculum. In building the OpenSciEd middle grades materials, this collaborative effort has harvested the wisdom and experience of teachers, students, researchers, and developers through rigorous field tests in diverse classrooms so that we know OpenSciEd materials support students in learning all dimensions of the NGSS. **OpenSciEd fosters a classroom culture of equitable participation where students from all backgrounds contribute and report that others take their ideas seriously.**

PHOTOS COURTESY OF THE KNOWLEDGE MATTERS CAMPAIGN

ANCHORED IN THE NGSS AND CLASSROOMS

OpenSciEd's beliefs about science learning and vision of the classroom are embodied in our Design Specifications. Specifications describe what we want science learning to look like for every student, therefore guiding our materials and implementation support. The topics addressed range from equitable science instruction and the centrality of asking questions to meeting the practical needs and constraints of a classroom. These specifications are based on *A Framework for K-12 Science Education* and the resulting Next Generation Science Standards, emphasizing the three-dimensional learning that integrates science and engineering practices, crosscutting concepts, and disciplinary core ideas.

The OpenSciEd Instructional model uses a storyline approach in which students are presented with puzzling phenomena that elicit various questions and motivates the learning in the unit. In OpenSciEd units, phenomena are carefully selected to anchor a storyline and inspire the development of target disciplinary core ideas, crosscutting concepts, and science and engineering practices. Through the development process, we queried thousands of students to make sure that our anchoring phenomena draw students into intriguing storylines by presenting the challenges of explaining something or solving a problem that is relevant to them.

Teachers and students advance through a unit storyline taking advantage of five routines (listed below)—activities that play specific roles in advancing the storyline to help students achieve the objectives of those activities.

ANCHORING PHENOMENON ROUTINE

Kicking off a Unit with an Experience to Motivate Investigation

The Anchoring Phenomenon routine is used to kick off a unit of study and drive student motivation throughout the unit. The Anchoring Phenomenon routine aims to build a shared mission for a learning community to motivate students in figuring out phenomena or solving design problems. More specifically, it serves to ground student learning in a common experience and then use that experience to elicit and feed student curiosity, which will drive learning throughout the unit. The Anchoring Phenomenon routine is also a critical place to capture students' initial ideas as a pre-assessment opportunity and is introduced at the beginning of a unit.

NAVIGATION ROUTINE

Motivating the Next Step in an Investigation

The Navigation routine enables students to experience the unit as a coherent storyline in which each activity has a purpose and is connected to what has gone before and what is coming. It also provides a valuable opportunity for students to reflect on their learning over time. The Navigation routine is conducted throughout the unit at transition points to further solidify the connection between related science classroom resources and topics.

INVESTIGATION ROUTINE

Using Practices to Figure Out Science Ideas

The purpose of the Investigation routine is to use questions around a phenomenon that lead the class to engage in science practices to make sense of the phenomenon, and then develop the science ideas as part of the explanation. This is the basic structure of the work of three-dimensional learning. The Investigation routine is conducted throughout the unit, whenever students identify gaps in their understanding of the Anchoring Phenomenon.

PROBLEMATIZING ROUTINE

Motivating Learning through Each Part of a Unit

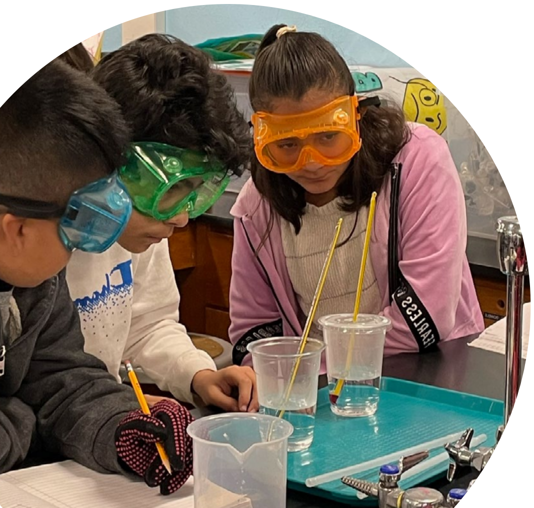
In OpenSciEd's science classroom resources and units, the purpose of the Problematizing routine is to reveal a potential problem with the current model or explanation in order to motivate students to extend or revise their models. The teacher seeds, cultivates, and capitalizes on an emerging disagreement that reveals the potential problem and gets students to focus on an important question that could extend their science models. The Problematizing routine is often conducted after a Putting Pieces Together routine or at strategic locations where students need to recognize that there is more to figure out.

PUTTING PIECES TOGETHER ROUTINE

Using the Science Ideas We've Built So Far

In the Putting Pieces Together routine, students take the ideas they have developed across multiple lessons and figure out how they can be connected to account for the phenomenon the class is working on. In our science classroom resources, this routine serves to help students take stock of their learning and engage with the class to develop a consensus representation, explanation, or model to account for the target phenomenon (the phenomenon anchoring the unit or learning set).

The Putting Pieces Together routine is conducted at strategic moments when students have synthesized evidence from a range of situations to construct an important component of the explanatory model. This is often at the end of a lesson set and at the end of the unit.



PHOTOS COURTESY OF THE KNOWLEDGE MATTERS CAMPAIGN

INSTRUCTIONAL SUPPORTS

Embedded in the OpenSciEd units are instructional supports that allow educators to provide a more holistic educational experience for students. They include support for assessing student learning and instructional differentiation for learners with a variety of needs.

SUPPORT FOR ASSESSING STUDENT LEARNING

OpenSciEd has developed an assessment system grounded in the recommendations of the National Research Council (2014) report, *Developing Assessments for the Next Generation Science Standards*. An assessment system is a holistic way that supports teacher autonomy and multiple ways for students to demonstrate their ability to reason with the three dimensions. The OpenSciEd assessment system has five kinds of assessment embedded in the unit: formative, summative, pre-assessment, self-assessment, and peer-assessment.

SUPPORT FOR DIFFERENTIATION

OpenSciEd units are designed with Universal Design for Learning principles to provide equitable and accessible learning from the outset of the units. By making supports available for all students, equitable and accessible design can reduce the need to consider differentiation only in the presence of students with learning differences. OpenSciEd units are also designed so that teachers can adapt the materials as necessary without diminishing the learning experiences for students.

SUPPORTING EMERGING MULTILINGUAL LEARNERS (EMLs)

The curricular design and routines embedded in the curriculum ground student learning experiences in real-world phenomena. For instance, a 6th grade unit on thermal energy is anchored in students answering—how can containers keep stuff from warming up or cooling down? In this approach to science learning, students are not just memorizing science ideas or "facts" about energy transfer. Instead, they are working with peers to come to their own understanding and design solutions for interesting problems in the world. When the phenomena being explored are relevant and accessible, EMLs can better contribute and build from their previous understandings of the phenomena.

OpenSciEd teacher materials also include callouts focused on EMLs, often appearing as supplemental text on the margins of lesson plans. These educative boxes support teachers in considering whether particular learning moments might be spaces where they can leverage their EMLs' assets and address potential challenges their students might encounter. These boxes also help teachers provide additional in-time support and explain why these instructional moves are essential for EMLs. They also range greatly, from suggesting particular ways to group students to unpacking the meaning of certain words in the context of science.