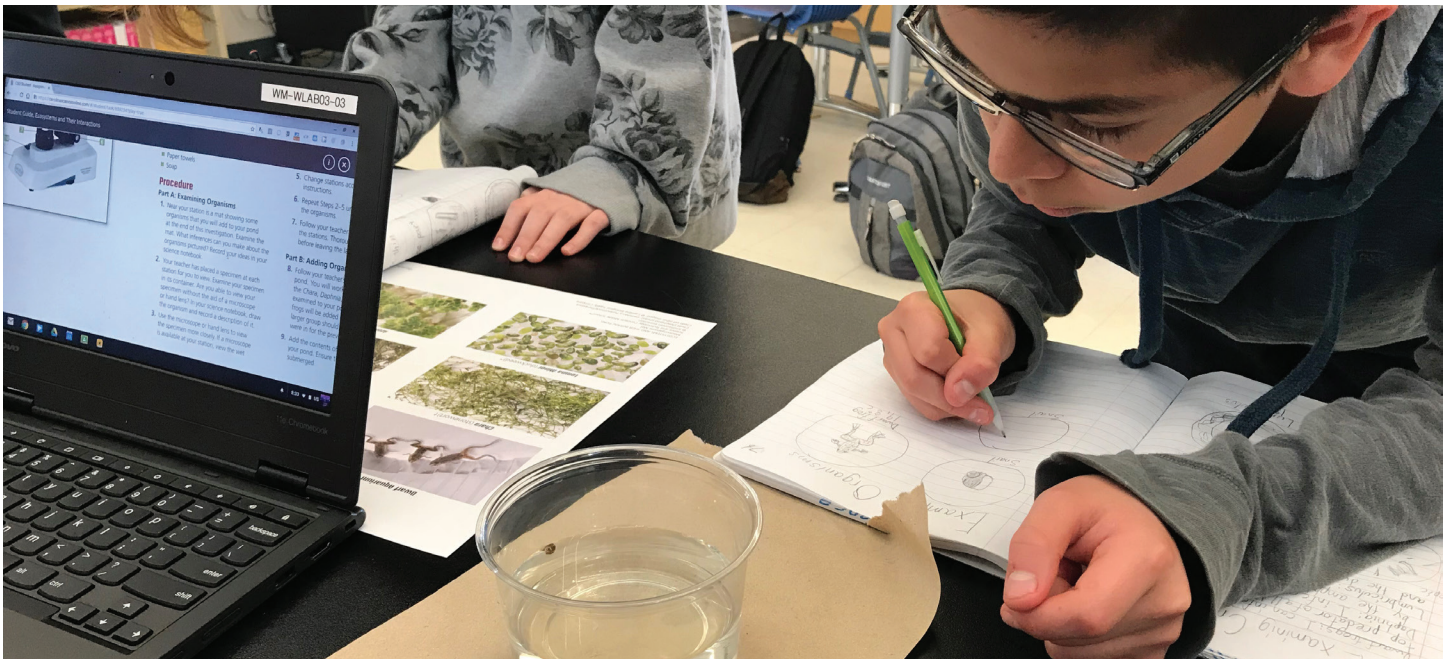
Smithsonian
Science Education Center



What Middle School Assessment Should Look Like

What makes a system for assessing middle school students' learning with multidimensional standards truly great? In a curriculum aligned to Next Generation Science Standards† (NGSS), the ultimate learning goals are a selection of targeted performance expectations. But in grades 6, 7, and 8, performance expectations are goals that students should be able to meet by the end of the *entire grade band*, so any one module can only aim toward these goals. In addition, performance expectations are endpoints—not sequences of lessons—so the smaller-scale, more-detailed goals appropriate to lessons and modules need to be unpacked while still examining aspects of student progress in all three NGSS dimensions: disciplinary core ideas, crosscutting concepts, and science and engineering practices.

What does this mean for school administrators and teachers? Professional development should guide teachers to engage students in demonstrating grade-appropriate thinking in a variety of contexts. In units designed to ultimately target a bundle of related performance expectations, for example, no one lesson, assessment, or assessment task may be aligned one-to-one with performance expectations. Instead, smaller pieces of knowledge and skills can be combined flexibly to develop lessons that build a coherent storyline, enabling the teacher to regularly assess these smaller pieces in stages to ensure students are getting the preparation they need to meet the rigorous performance expectations.

Stages of Assessment

A coherent system of teacher-led, classroom-based assessments can provide actionable information to students, teachers, and families and should require a range of higher order thinking so that *all* students—including those at the lower and higher ends of the achievement spectrum—can demonstrate their knowledge and abilities. The system should include a package of assessments designed with distinct and important purposes yet aligned closely to the same learning goals. Such an assessment package can be broken down into pre-assessment, formative assessment, summative assessment, and student self-assessment.

1 Pre-assessment

Pre-assessment is the data-gathering stage of assessment. Instead of focusing on individual students, this stage gives the teacher an opportunity to get a sense of the strengths and weaknesses of the class as a whole. Tasks should be designed to identify students' current skills in key science and engineering practices as well as the knowledge students naturally draw on. Pre-assessment tasks should:

- Gauge student prior knowledge of key disciplinary core ideas and crosscutting concepts
- Guide teachers in lesson planning
- Be configured to allow teachers and students to revisit the tasks throughout the unit to observe progress

Teacher knowledge gathered through pre-assessment tasks is not intended to provide feedback to students. Individual feedback should occur after students have had more instruction.

Tip for the teachers . . .
Begin the pre-assessment by having the class complete a Know/Want to Know/Learned (KWL) chart.

2 Formative Assessment

An ongoing process throughout instruction, formative assessment provides the information that lets teachers adjust teaching and learning while students are still developing an understanding of the concepts and ideas. Like pre-assessment, formative assessment is data driven and informs instruction, but it should also be used to provide timely and constructive feedback to individual students. In each lesson, teachers should look for:

- Tasks that focus on one or more disciplinary core ideas, crosscutting concepts, and/or science and engineering practices
- Student responses that demonstrate thinking across the three dimensions for the unit's central concepts and practices

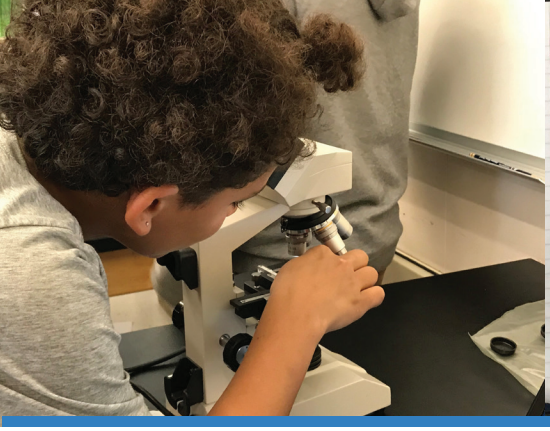
Tip for the teachers . . .
Following a lesson, include a hands-on exit task that focuses on a core idea, crosscutting concept, and/or science and engineering practice, depending on the focus question in the unit storyline.

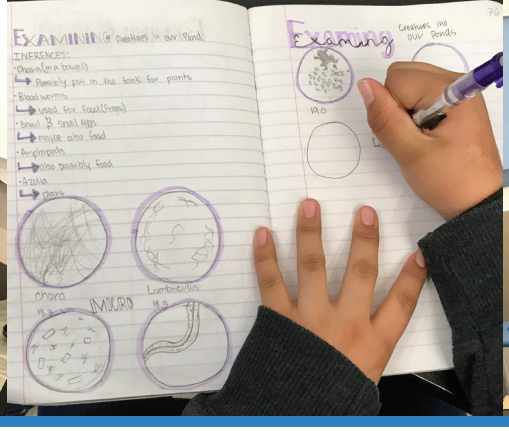
3 Summative Assessment

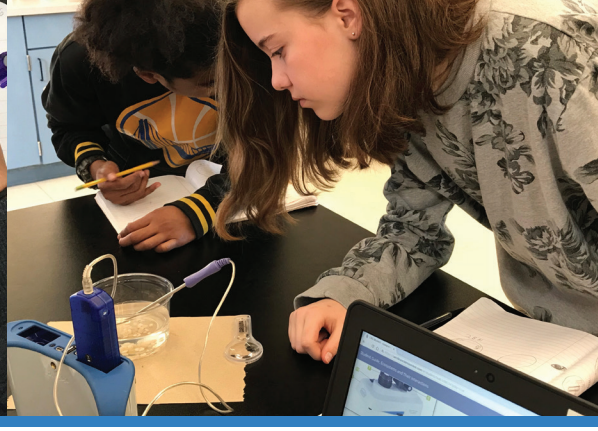
The summative assessment formally measures students' abilities to meet the targeted learning goals for a unit of instruction. In these assessments, grading and scoring are appropriate, but teachers should also provide feedback to students on accomplishments and areas for growth. To assist teachers in summative assessment, look for materials that include the following:

- Criteria that specifies key disciplinary core ideas, crosscutting concepts, and science and engineering practices to aid in analysis of student work across the dimensions
- Units with grading rubrics and scoring guides

Tip for the teachers . . .
Include both written and performance components that assess the student as beginning, developing, or proficient across the three dimensions.







4 Student Self-Assessment

Beginning with pre-assessment tasks, students should check in on their own learning and revisit their responses throughout their work on the unit. The self-assessment should encourage them to:

- Become aware of their strengths and weaknesses
- Think of ways to improve their learning strategies

Tip for the teachers . . .
Following each lesson, have students dig deeper into learning by evaluating their predictions, reflecting on the focus questions, and thinking of new questions.

Student Feedback

Clear, actionable feedback during formative and summative assessments can have a notable impact on students' conceptual understanding, self-regulation, motivation, and mindset. Research-based tips for high-quality feedback include the following:

- Feedback should be timely, providing an opportunity for students to make improvements based on the feedback.
- Feedback should include praise for successes along with critiques.
- Praise should always be directed at the task, its components, or the students' learning strategies—not the students themselves or their intelligence.
- Critiques should be constructive—they should be tied to advice or action points for improvement.

Research has also shown that, during formative assessments, students who receive feedback tied only to grades are more likely to take on a performance goal (looking good to others) rather than a mastery goal (progressing in understanding). In contrast, feedback alone (without grades) is more likely to increase students' interest in continued learning. During summative assessment, it is appropriate to assign grades. However, encourage teachers to provide feedback prior to showing the grades to students. Using partial-credit options helps clarify for students that their learning is on a continuum.

Making Connections, Making Sense

Before the new standards, educators evaluated learning based on acquired skills, or the ability to carry out procedure. But in an NGSS-aligned curriculum, assessment focuses on students' ability to *apply* those skills, making sense as they deepen their exploration. Following are examples of assessing skills (*before* NGSS) versus assessing science and engineering practices (*after* NGSS)[‡]:

- **Before**—Observe a pattern from a graph (e.g., there is an increase).
  After—Analyze a pattern in a graph to provide evidence to answer a question or support/refute an idea.
- **Before**—Take an accurate reading from a graduated cylinder.
  After—Define the variables and measurements needed to be part of an investigation to answer a question.
- **Before**—Label the consumers, producers, and decomposers in a food web.
  After—Use a food web to predict what happens when one component of the web is eliminated.

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STC
SCIENCE AND TECHNOLOGY CONCEPTS™
MIDDLE SCHOOL

STCMS™ Learning Framework

Grades 6–8

PHYSICAL*Science*	**LIFE***Science*	**EARTH***Science*
Energy, Forces, and Motion PS2-1, PS2-2, PS2-3, PS2-5, PS3-1, PS3-2, PS3-5, ETS1-1, ETS1-2, ETS1-3, ETS1-4	**Ecosystems and Their Interactions** LS1-5, LS1-6, LS2-1, LS2-2, LS2-3, LS2-4, LS2-5, LS4-4, LS4-6, ESS3-3, ETS1-1, ETS1-2	**Weather and Climate Systems** ESS2-4, ESS2-5, ESS2-6, ESS3-2, ESS3-4, ESS3-5, PS3-4, ETS1-1, ETS1-2
Matter and Its Interactions PS1-1, PS1-2, PS1-3, PS1-4, PS1-5, PS1-6, PS3-4, ETS1-1, ETS1-2, ETS1-3, ETS1-4	**Structure and Function** LS1-1, LS1-2, LS1-3, LS1-6, LS1-7, LS1-8, LS4-2, LS4-3	**Earth's Dynamic Systems** LS4-1, ESS1-4, ESS2-1, ESS2-2, ESS2-3, ESS3-1, ESS3-2, ETS1-1, ETS1-2, ETS1-3, ETS1-4
Electricity, Waves, and Information Transfer LS1-8, PS2-3, PS2-5, PS3-3, PS3-4, PS3-5, PS4-1, PS4-2, PS4-3, ETS1-1, ETS1-2, ETS1-3, ETS1-4	**Genes and Molecular Machines** LS1-1, LS1-4, LS3-1, LS3-2, LS4-4, LS4-5, LS4-6	**Space Systems Exploration** PS2-4, ESS1-1, ESS1-2, ESS1-3, ETS1-1, ETS1-2

Why Are Honey Bees Disappearing?
LS3-2, LS1-4, LS1-5, ESS3-3, ETS1-1

What Evidence Suggests Similarities Among Organisms?
LS4-1, LS4-2, LS4-3, ESS1-4

How Can We Use Technology to Monitor Aquatic Ecosystems?
PS4-1, PS4-2, PS4-3, ESS3-4

Three-dimensional learning for middle school

For more information, contact curriculum@carolina.com

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*Adapted from "Best Practices for Assessment Using STCMS™" from the Smithsonian Science Education Center's Science and Technology Concepts™ middle school curriculum

†Next Generation Science Standards® is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of, and do not endorse, these products.

‡Achieve. March 2018. Criteria for Procuring and Evaluating High-Quality and Aligned Summative Science Assessments, Version 1.0.

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