

In a Nutshell...

Project 2061's evaluations of science textbooks² highlight the need for better phenomena and representations in middle grades materials. NSDL collections are a potential source; however, they are mainly geared towards high school and undergraduate education. MMSA staff, trained by AAAS Project 2061, are working with teams of middle school teachers to analyze approximately 1,000 digital phenomena and representations for their alignment to middle grades content standards and for the quality of their instructional support for teachers. Reviews of these resources are being assembled into a collection called PRISMS (Phenomena and Representations for the Instruction of Science in Middle Schools), designed to increase the number of quality K-12 science educational resources accessible through digital libraries.

Objectives

The PRISMS project will:

- Review 1,000 phenomena and representations found in digital libraries and identify those that are aligned to national science content standards and are consistent with the research on effective teaching and student learning.
- Describe and annotate these resources to encourage their effective use by teachers.
- Build capacity among middle school teachers, curriculum developers, and other NSDL users to select, analyze, try out, and contribute resources to digital libraries.

What are phenomena and representations?

Phenomena and representations are specific types of educational resources.

"Phenomena" are real-world objects, systems, and events that provide evidence of, or are consistent with key ideas³.

"Representations" are pictures, video clips, graphs, simulations, and analogies that can help clarify key ideas⁴.

Analyses and Testing by Teachers

Analyses of Phenomena and Representations. Based on the prioritization of benchmarks for resource selection, teacher analysts are assigned science benchmarks and suggested web sites to review. Figure 1 shows the custom utility that we are using to capture the analysts' judgments using a subset of Project 2061's curriculum analysis criteria that is specific to phenomena and representations.

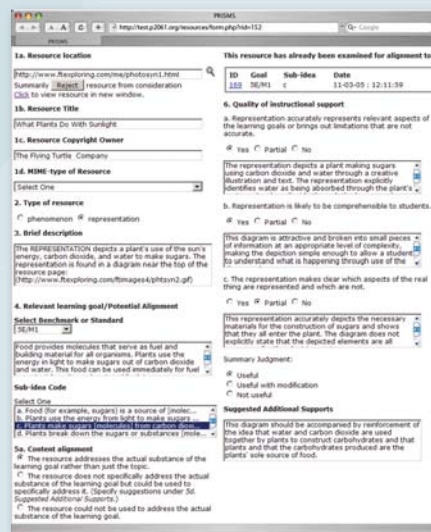


Figure 1.

A custom online resource review utility with phenomenon selected as the resource type (#2). Resources are initially examined for alignment to a specific learning goal (content analysis) and then evaluated for the quality of their instructional support. Suggestions for modifications to make the resource more effective are also noted.

Examples. Tables 1 and 2 show examples of phenomena and representations that were judged to be either useful or not useful according to the curriculum analysis criteria.

Teacher Testing and Feedback. As the PRISMS site is built, the resources in the collection will be available to the middle school teacher analysts and other teachers working on projects with the MMSA, who will try them out with students and provide feedback in the form of annotations about their use in the classroom.


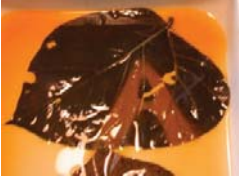
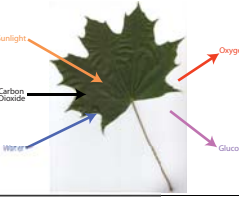
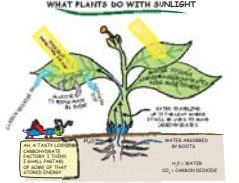
Table 1. Phenomena examined for the idea, "Plants use the energy in light to make sugars out of carbon dioxide and water."	
NOT USEFUL	 <p>In a chromatography activity, students can see that there are many pigments in a green leaf. While the phenomenon helps explain why leaves change color in the fall as the leaves lose their (green) chlorophyll, it does not help students understand the actual idea of plants making sugars from carbon dioxide and water.</p>
USEFUL	 <p>Certain processes can be used to discolor the parts of a leaf that contain starch, a chemical that indicates the presence of sugars. If students cover part of a leaf for several days to prevent sunlight from striking it and then check for the presence of sugars, they will observe that the parts that were in sunlight have more sugars than the parts that were covered. This phenomenon provides evidence that sunlight is needed by the plant to produce sugars, one aspect of the learning goal.</p>

Table 2. Representations examined for the idea, "Plants use the energy in light to make sugars out of carbon dioxide and water."	
NOT USEFUL	 <p>Students looking at this representation may mistakenly assume that sunlight is a material reactant in the process of photosynthesis and that plants give off glucose. They may also think that water enters through the leaf.</p>
MAY BE USEFUL	 <p>This representation provides a better sense of how water gets to the leaf but does not clarify the relationship between reactants and products. To give students a clearer sense of the transformation of matter, it could be supplemented to show the assembly of products from reactants.</p>

Findings

To date, 569 phenomena and representations that appeared to be relevant to a learning goal have been analyzed for their content alignment and quality of instructional support. Of these, only 25% have been found by reviewers to be useful as is.

¹ This work is funded by NSF Grant #DUE 0435217.

² <http://www.project2061.org/tools/textbook/mgsci/index.htm>.

³ Examples can be seen at: <http://test.p2061.org/curriculum/test0310/phenom.htm>.

⁴ Examples can be seen at: <http://test.p2061.org/curriculum/test0310/represent.htm>.