Exploring High Quality Instructional Materials (HQIM) in Science

dpi.wi.gov/science/materials

WISCONSIN DEPARTMENT OF
Public Instruction
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What is your vision for science learning?

"[By] the end of 12th grade, *all* students have some appreciation of the beauty and wonder of science; possess sufficient knowledge of science and engineering to engage in public discussions on related issues; are careful consumers of scientific and technological information related to their everyday lives; are able to continue to learn about science outside school; and have the skills to enter careers of their choice, including (but not limited to) careers in science, engineering, and technology."

Before using this module…

- Before using this module, your team should have a solid understanding of the Wisconsin Standards for Science (or the Next Generation Science Standards).
  - Need further learning? Check out the Online Wisconsin learning modules on the design of 3D standards (NGSS/WSS), creating assessment, and doing science with these standards.

- Your team should also have a discussed a shared vision and determined priorities for student learning

- This module then guides you through key considerations for quality materials and provides the opportunity to explore tools that can guide you through a selection process.

  *Note, this module is not an in-depth walk through a materials selection process, but an initial discussion guide to be sure that process will be effective.

Goals of this Module

1) Explore six key **look-fors** in science materials that should be part of high quality instructional materials
   In the materials, how are students:
   a. Supported in making sense of the world around them?
   b. Using the practices, content, and ways of thinking (three dimensions) of the standards?
   c. Guided in a coherent storyline of learning?
   d. Engaging with scientific phenomena and solving engineering problems?
   e. Equitably supported in their learning?
   f. Authentically assessed?

2) Review characteristics of an effective materials selection process and two resources options to evaluate alignment of materials

Where did we get the examples?

Many examples in this module come from OpenSciEd, because it's free and exemplifies the key aspects of high quality materials. Other programs also connect well to these aspects, but OpenSciEd is particularly easy to access and review.

1 - Make sense of the world

- The core statement of the Wisconsin Science Standards is, “Students use science and engineering practices, disciplinary core ideas, and crosscutting concepts to make sense of phenomena and solve problems.”

- What do we mean by students making sense of the world around them?
  - In the first lesson of Unit 6.2 of OpenSciEd students are told about a claim that a “fancy cup” will prevent ice from melting better than a regular cup. Their teacher really likes that idea to keep her Diet Coke from getting watered down! They’re then shown this image, along with the cups in real-life, and asked, “What do you notice? What do you wonder?”
  - What is the value of this unit set-up?

1a - Support sensemaking through discourse

- If students are going to talk about phenomena, like the fancy cup vs. the regular cup, they need support in talking to each other - discourse!
- The STEM4ELs project has some great resources to support student/classroom talk.
- Watch the video on the bottom left of this website - What do you notice? What do you wonder?

1b - Model and explain as part of sensemaking

- In the OpenSciEd Thermal Energy Unit (fancy and regular cups), after some initial observations, discussion, and data collection, students create an initial model to explain why the fancy cup might keep the water colder longer. They are specifically asked to consider the “system” of the two cups.
- Optional: on a blank sheet of paper, create your own model of a double-walled (fancy) cup and the regular cup to show the systems involved. Modeling is a great way to support sensemaking.
- This 10 min video from Ambitious Science Teaching presents an example of students’ iterative modeling to support their explanations.
    - How does the teacher support their sensemaking?

2 - Use the practices, content, and ways of thinking (three dimensions) of the standards

- As noted before, the key statement of a Wisconsin Standard for Science is, “Students use science and engineering practices, disciplinary core ideas, and crosscutting concepts to make sense of phenomena and solve problems.”

- Review this listing of the three dimensions of the science standards.
  - In the OpenSciEd thermal energy lesson example (including your optional scientific modeling), which science and engineering practices, disciplinary core ideas, and crosscutting concepts did you use?

3 - Move through a coherent storyline of learning

- What does coherence in science unit mean to you?
- Optional: read this article on coherence in science materials.
  - How do they define coherence?
  - Why is it important for student learning?
  - Reflect on the coherence of your last unit. What was successful? What could have been improved?

- Take 5 minutes to review the OpenSciEd storyline for the Thermal Energy unit.
  - How does it build over time? Or, in other words, how are students guided in deeper learning through each lesson?
  - What are some key science concepts learned along the way that happen over multiple days?
  - What is meant by a “storyline”?

4 - Make sense of scientific phenomena and solve engineering problems

- As noted, we want students making sense of phenomena. But, what are the qualities of a good phenomenon?
  - Review this short article on what makes good phenomena.
  - Share: what resonates or what questions do you have?
  - How well did the recent phenomena from your classroom meet these criteria?

- Students in science are not only making sense of phenomena, but they're also solving engineering problems related to the science they're learning.
  - Note that in lessons 15-17 of the OpenSciEd thermal energy unit students review design principles of effective cups then design and test their own cup system to keep a drink colder for longer.

5 - Support equitable learning

- A key part of equitable learning is connecting learning to students' identities, as described in the Cultivating Genius Framework from Dr. Gholdy Muhammad.
  - How does the OpenSciEd thermal energy unit with the cups connect to students identities?
  - Are their other energy phenomena that might be connect to students?
  - This module on modifying units can also help in adapting unit to better connect to your students/community.
- OpenSciEd includes a key reflection protocols to support student understanding, the Navigation Routine Tracker. Stopping to review past questions, understanding, and new/remaining questions supports deep learning.
  - They also have supports for teaching multilingual learners.
- Some materials pre-teach vocabulary to support learning, though this strategy is not supported by research. Learning vocabulary in context is best.

6 - Assess authentically

Assessment overview of thermal energy (cup) unit.

- What do you notice about the formative and summative assessments?
- What questions do you have?

Take a look at a recent assessment from your classroom.

- How did it support student sensemaking?
- Are there clear connections to each of the three dimensions?
- How do students receive feedback (rather than grades)?

Reflection on Six Look-fors in Materials

Which of these look-fors are your top priorities? Why?

- Sensemaking
- Using the practices, content, and ways of thinking (three dimensions)
- A coherent storyline of learning
- Meaningful scientific phenomena and engineering problems
- Equitable support
- Authentic assessments

Selection Process and Resources

Shifting gears - We'll now move from the 6 look-fors in materials to considering the materials selection process.

- Does your district have a defined process for evaluating and selecting materials?
  - What are its strengths and what challenges come up during it?
- Instruction Partner's Curriculum Support Guide is a common process across WI.
  - Look through the overview of this process. How is it similar or different to what you're doing or what you've done in the past?
  - Note: your local CESA has people who are trained in facilitating the Instruction Partners process.

Selection Process and Resources

The Curriculum Support Guide, or other process your district might use, is general to all curricular areas. You'll need a science specific review tool that calls out the nuances of the standards and science instruction.

- A group of Wisconsin educators created this tool for reviewing resources (Word file).
  - Take 5-6 minutes to review it.
  - What categories resonate? Which are lower priorities?
  - Would you and how might you use this tool in your process?

Selection Process and Resources

There are other tools to review science specific criteria for materials. One of the most thorough and nationally recognized tools is NextGenTIME.

- This tool guides you through a Prepare, Prescreen, Paperscreen, Pilot, and Plan process. You will deeply dive into a unit of the materials under consideration and pull out evidence of student sensemaking, the three dimensions of the standards, and other support qualities.
- Choose one of the five parts of the process (using the links on this page or the top menu on the website) and investigate further.
    - Share what you found with other groups/educators.

- What are the pros and cons of a more in-depth review process?

Review Goals

How well did we meet the goals of this module?

- Explore six key look-fors in science materials that should be part of high quality instructional materials
  - How are students:
    1. Supported in making sense of the world around them?
    2. Using the ways of thinking, practices, and content (three dimensions) of the standards?
    3. Guided in a coherent storyline of learning?
    4. Engaging with scientific phenomena and solving engineering problems?
    5. Equitably supported in their learning?
    6. Authentically assessed and provided feedback on their learning?

- Review characteristics of an effective materials selection process and two resources options to evaluate alignment of materials

Final Reflections and Next Steps

Personally reflect on these questions for 5 minutes, then share as a group.

- Are you united in your vision for science learning? Do you have any new ideas on what that vision could include?
- Does everyone on your team have enough understanding of the standards to be able to comfortably contribute within the process? Will your norms to support this comfort?
- What do you think your next steps are?
- What further supports does your team need to be successful?

Conversations & Support

Need further resources? Have a question?
Need virtual or in-person support?

Contact me! Kevin.Anderson@dpi.wi.gov